AVIATION WEEK

A McGRAW-HILL PUBLICATION

JULY 16, 1956 50 cents

Air Traffic Snarl June 21 Was One of Worst Ever

Cessna 310s

Army Will Try Launching Missiles From Helicopters

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Today, Axelson produces landing gears, shock struts, spars, geared mechanisms, hydraulic components and other precision equipment . . . for such aircraft as the A3D, A4D, B47, B52, B57, B66, F8U, F9U.

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For 30 years, the aircraft industry has looked to Axelson for *proven* production know-how. Now, a new look* at Axelson shows even greater depth in research, design and development . . . broader on-schedule service . . . available for complete programs or individual precision components.

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The experience of more than 36 years of design and manufacture of precision equipment systems has given Sargent Engineering Corporation the "know-how" to aid in solving the essential and advance problems of force control. Leading airframe and missile manufacturers are using hundreds of different Sargent hydraulic, mechanical, pneumatic, electrical and electronic force control units on the nation's military planes, commercial planes and missiles.

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BUILDS QUALITY THAT BUILDS GOOD WILL

AVIATION CALENDAR

July 31-Aug. 9—23rd U. S. National Soaring Competitions, **Aug. 5**—Air Show, Grand Prairie Airport, Grand Prairie, Texas.

Aug. 1-5—Air Force Association's 1956 National Convention and Airpower Panorama, Roosevelt Hotel, New Orleans, La.

Aug. 6-8—Society of Automotive Engineers National West Coast Meeting, Mark Hopkins Hotel, San Francisco, Calif.

Aug. 7-9—Air Transport Association Standard Practices Committee Meeting, Palace Hotel, San Francisco, Calif.

Aug. 15-17—Institute of the Aeronautical Sciences, National Turbine-Powered Air Transportation Meeting, Grand Hotel, San Diego, Calif.

Aug. 21-24—Western Electronic Show and Convention, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles.

Aug. 22-24—Bendix Aviation Corp.'s 1956 International Ignition Conference, Sidney, New York.

Aug. 27-29—Association for Computing Machinery, University of California Westwood Campus, Los Angeles.

Sept. 9-11—International Northwest Aviation Council, 20th annual convention, Boise, Idaho.

Sept. 10-14—American Society of Mechanical Engineers, Instruments & Regulators Div. Meeting, Detroit, Mich.

Sept. 16-22—American Society for Testing Materials, Second Pacific National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles.

Sept. 17—International Air Transport Association, 12th annual general meeting, Edinburgh, Scotland.

Sept. 17-21—Eleventh Annual Instrument-Automation Conference & Exhibit, sponsored by the Instrument Society of America, Coliseum, New York, N. Y.

Sept. 17-22—International Congress of Astronautics, sponsored by the International Astronautic Federation, Rome, Italy.

Sept. 23-26—American Society of Mechanical Engineers, Petroleum Conference, Hotel Statler, Dallas, Tex.

Sept. 25-29—Second European Aeronautical Congress, authorized by the Association International des Constructeurs de Materiel Aeronautique, Kurhaus Hotel, Scheveningen, The Hague, Netherlands.

AVIATION WEEK • JULY 16, 1956

Vol. 65, No. 3

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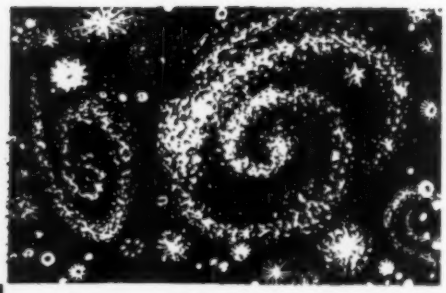

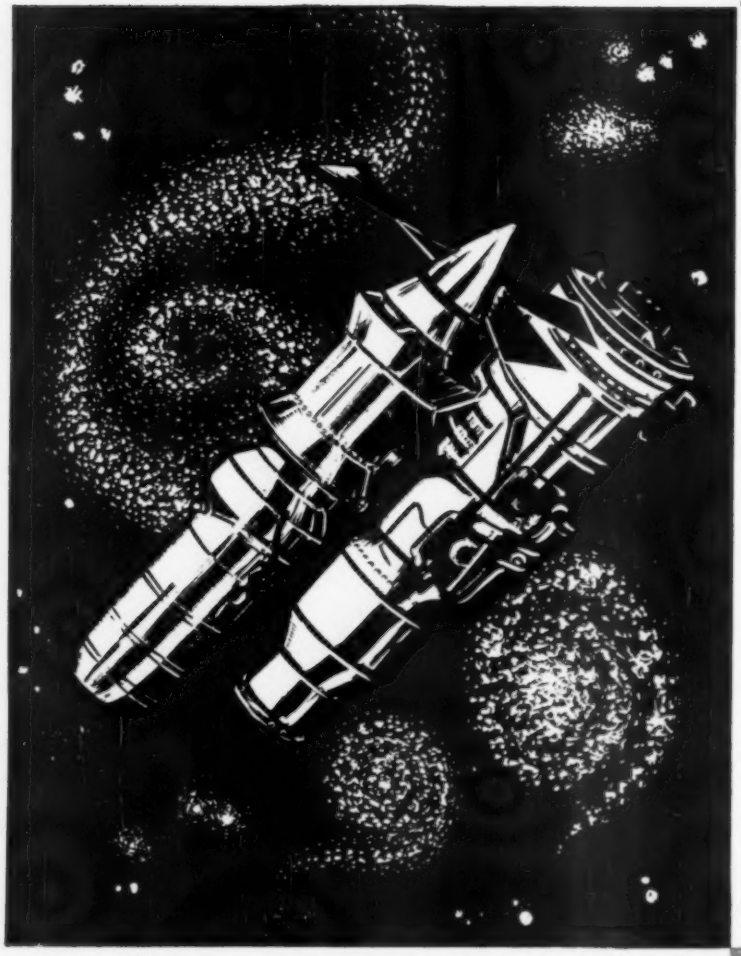

Today, it's the R-1820, R-1830, R-1340, R-985, R-2000, R-2800-B, R-2800-CA and CB, R-3350 and R-4360 engines that provide the power to propel the nation's larger airplanes. Tomorrow, it may well be the turbine and jet engine that provides the power to fly the nation's airplanes.

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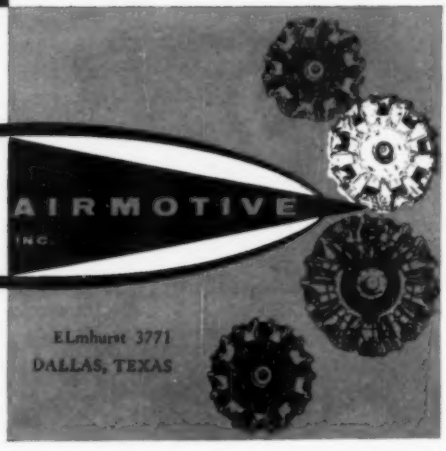

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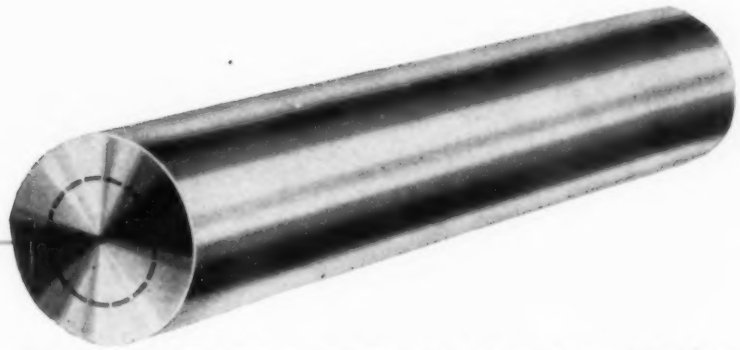
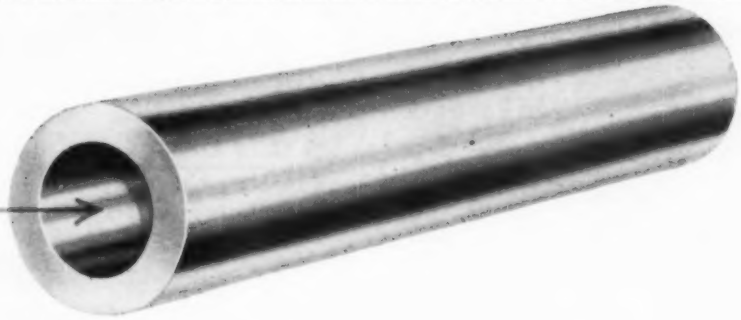


When you can start with this?



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If you're making hollow parts, and bore cut *solid* bar stock, you're paying for steel you don't use. But Timken® seamless steel tubing comes with *the hole already there.* You pay only for steel you use. On top of this saving, you cut machining costs. By eliminating that unnecessary boring operation, you free part of your screw machines for other jobs—add machining capacity without adding machines.

Our engineers will be glad to recommend the most economical tube size for your hollow parts job. By studying your problem and making recommendations, they'll save you money—and the Timken seamless steel tubing they suggest will be guaranteed to clean up to your finished dimensions.

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SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

Precision IS OUR MOST IMPORTANT PRODUCT

***P**recision* in engineering...*Precision* in production ...*Precision* in performance typifies airplane and rotary wing aircraft equipment made by ADEL.

ADEL has applied modern techniques to the *precision* field with impressive results in accuracy and performance. Many units have been *first in concept ...first in production...first in application* and *all* meet or exceed applicable specifications.

As aviation's creative science develops new performance concepts, ADEL will translate these visions into reality by *precision* engineering, *precision* design simplification and *precision* manufacturing. Efficient performance is our only criterion for service, reliability and effective operation.

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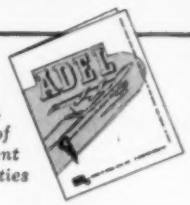

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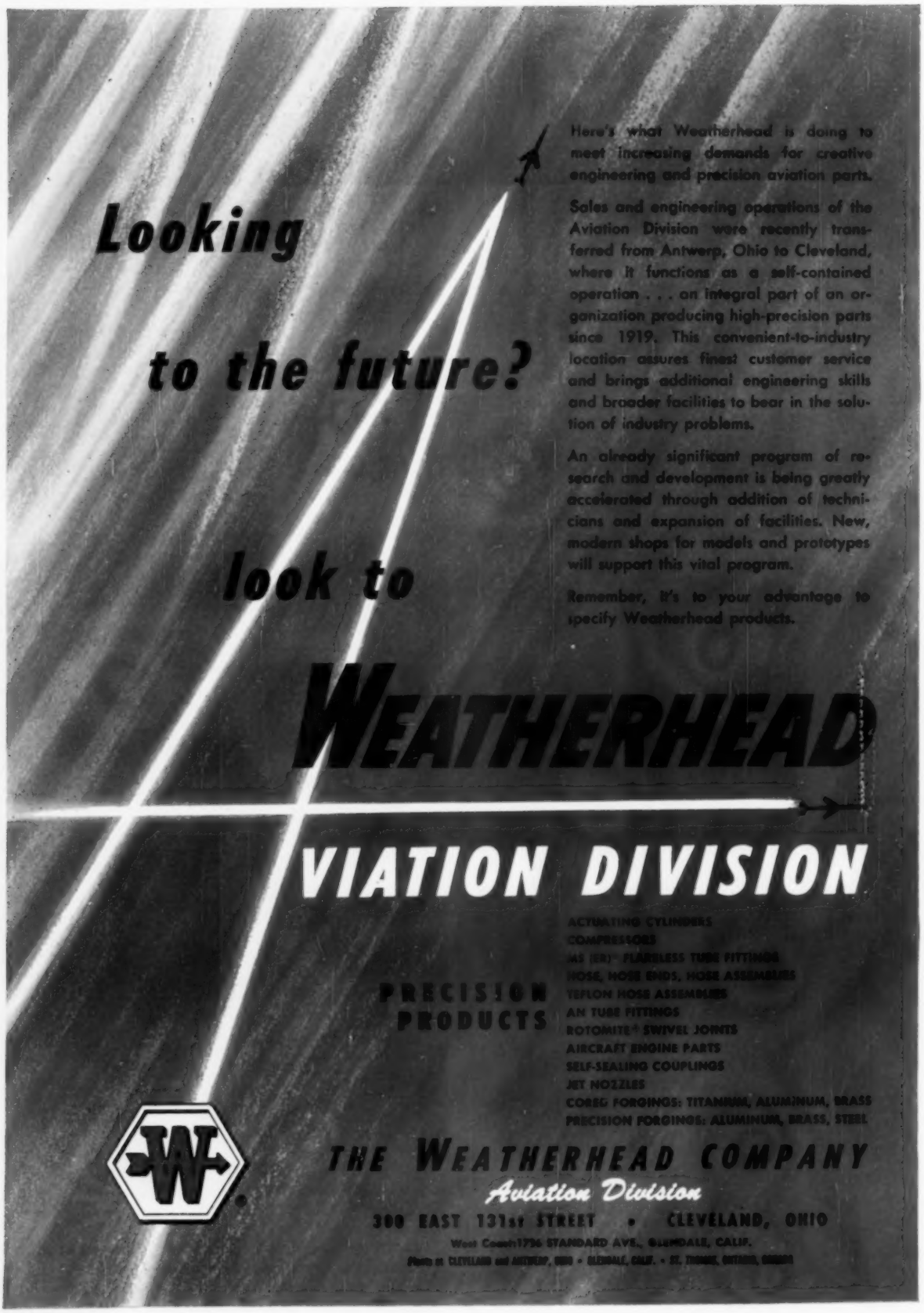
Looking
to the future?
look to
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VIATION DIVISION
Here's what Weatherhead is doing to meet increasing demands for creative engineering and precision aviation parts.
Sales and engineering operations of the Aviation Division were recently transferred from Antwerp, Ohio to Cleveland, where it functions as a self-contained operation . . . an integral part of an organization producing high-precision parts since 1919. This convenient-to-industry location assures finest customer service and brings additional engineering skills and broader facilities to bear in the solution of industry problems.
An already significant program of research and development is being greatly accelerated through addition of technicians and expansion of facilities. New, modern shops for models and prototypes will support this vital program.
Remember, it's to your advantage to specify Weatherhead products.
PRECISION PRODUCTS
ACTUATING CYLINDERS
COMPRESSORS
MS (ER)* FLARELESS TUBE FITTINGS
HOSE, HOSE ENDS, HOSE ASSEMBLIES
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AN TUBE FITTINGS
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WHY straight cylindrical roller bearings are a must in jet engines

WHY Hyatt is America's No. 1 producer of jet engine roller bearings

No need to remind you of the "why" of that first statement: nothing else will take the terrific rpm's of today's jets *and—at the same time*—automatically compensate for the inevitable heat expansion of turbine shafts by letting them "float" laterally.

But perhaps you're not so familiar with the reasons why HYATT Roller Bearings are the overwhelming choice of jet engine builders:

1. HYATT HAS THE FLEXIBILITY to work out new bearing designs in cooperation with aircraft engineers.

2. HYATT HAS THE CAPABILITIES—the experience and the equipment—to come up with precision prototypes that meet or exceed your design requirements.

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REPUBLIC

to help you push back

Republic—world's largest producer of aircraft steels—is ready to help you in two ways. First, with the materials needed to combat heat as well as strength-to-weight and corrosion problems. And second, with metallurgical service backed by over a quarter century of experience gained through helping hundreds of designers and manufacturers in all types of industries meet and solve similar problems.

To date two materials, titanium alloys and stainless steels, best qualify to meet the severe service requirements for skin of aircraft and missiles flying at supersonic speeds.

Republic melts and rolls titanium in all forms—forging billets, hot rolled and cold finished bars, plate, sheet and strip.

REPUBLIC STEEL

NEW DEVELOPMENTS create new uses. A unique tank truck with one compartment made of ENDURO Stainless Steel safely handles a corrosive alcohol-water mixture used in turboprop engines. Another compartment, for kerosene, is fabricated from Republic High Strength Steel for extra strength without added weight.

WEIGHT—On the DC-7 superliner, a weight saving, equivalent to one passenger and his luggage, resulted when Titanium replaced other materials normally used in nacelle construction. And with no sacrifice in strength or safety. Titanium offers the highest strength-to-weight ratio of construction metals.

SOLVING HEAT PROBLEMS is old stuff for ENDURO Stainless Steel. ENDURO's ability to withstand heat without loss of strength has been proved on jet engines where it is used for structural and burner components, rings, exhaust systems, afterburners. Now it is being used for skin material to resist high temperatures at supersonic speeds.

STEEL IS READY

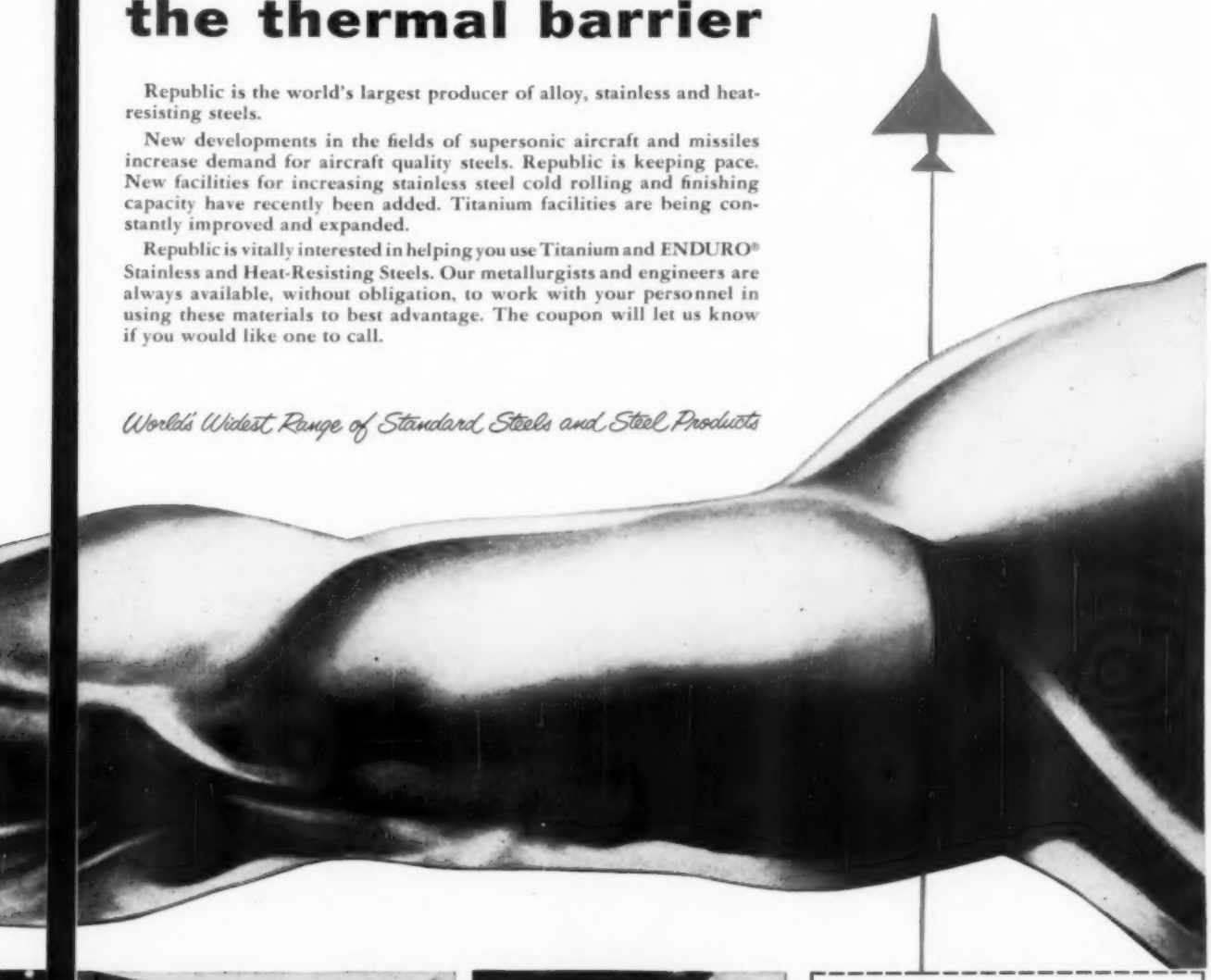
the thermal barrier

Republic is the world's largest producer of alloy, stainless and heat-resisting steels.

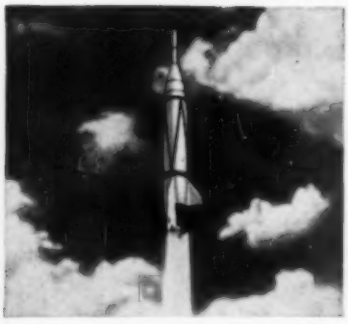
New developments in the fields of supersonic aircraft and missiles increase demand for aircraft quality steels. Republic is keeping pace. New facilities for increasing stainless steel cold rolling and finishing capacity have recently been added. Titanium facilities are being constantly improved and expanded.

Republic is vitally interested in helping you use Titanium and ENDURO® Stainless and Heat-Resisting Steels. Our metallurgists and engineers are always available, without obligation, to work with your personnel in using these materials to best advantage. The coupon will let us know if you would like one to call.

World's Widest Range of Standard Steels and Steel Products



STRENGTH—Landing gear fabricated from Republic Alloy Steels can take the tremendous strain when aircraft hit the runway at high speeds. These fine steels provide the high strength and toughness needed to withstand high impact and heavy loads—provide the hardenability to resist wear at bearing surfaces.



CORROSION-RESISTANCE—Titanium's extremely high corrosion-resistant properties make it attractive for many applications, such as tanks for acids used in combination with missile fuels. Nitric acid has negligible effect on Titanium. It is practically immune to salt water and sea air corrosion.

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- ☐ High Strength Steel
- ☐ Alloy Steel
- ☐ Titanium
- ☐ Have a metallurgist call.

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Company_____

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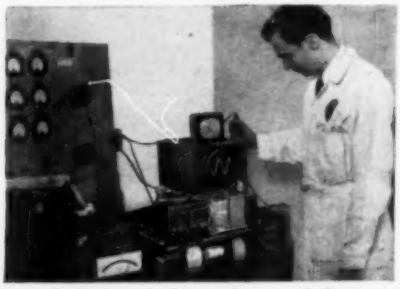
U. S. Army Photo

• One of eight permanent Ordnance Corps arsenals, Redstone is the center for the Army's rocket and guided missile program. Its 40,000 acres are located on the Tennessee River near Huntsville, Ala., and house research laboratories, environmental test equipment and several rocket-testing ranges. Redstone Arsenal's military and civilian scientists and engineers produce weapons ranging from a tiny training rocket to the giant IRBM, now being developed on a crash basis by the recently-established Army Ballistic Missile Agency.

From the research, development, production and field service headquarters located at Redstone flow thousands of directives covering the rocket and guided missile work being done by research laboratories, universities and private industry throughout the nation. Weapons systems developed by this Ordnance-Industry team include the Super Bazooka infantry rocket, the Honest John artillery rocket, the Corporal missile and the Nike anti-aircraft missile.

Scientific barriers of all kinds are being broken by the 9,000 employees of Redstone Arsenal, but the exciting and difficult technology of guided missile development constantly presents new problems. Electronic computers click away at missile trajectory formulas by day, while at night rockets equipped with headlights streak down-range, adding valuable data to our country's newest arsenal of defense.

REDSTONE BALLISTIC MISSILE — This long-range rocket-powered, bombardment weapon was developed by the arsenal's guided missile team headed by Dr. Wernher von Braun. The Redstone is the progenitor of the Army's IRBM, the Jupiter.



FORD ENGINEER checking voltage and frequency accuracy of power supply unit under simulated load conditions in a project for the Guided Missile Development Division of the Redstone Arsenal.

This is one of a series of ads on the technical activities of the Department of Defense.

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of unusual abilities can find a future at **FORD INSTRUMENT COMPANY.** *Write for information.*

REDUCE YOUR MACHINING COSTS

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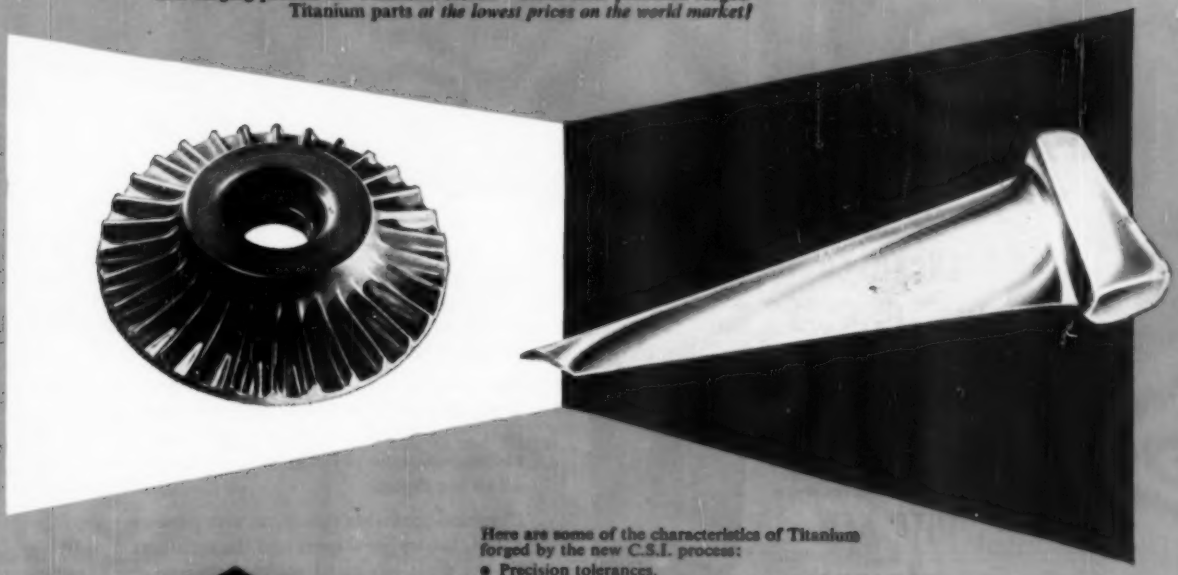
HIGH TEMPERATURE ALLOYS and TITANIUM

C.S.I. precision forging methods greatly reduce the cost of High Temp Alloy and Titanium parts in two important ways. One—tolerances are so close that machining time is reduced to a bare minimum. Two—C.S.I. methods drastically cut the amount of high priced metals required to produce a batch of forgings.
Canadian Steel Improvement have combined these cost-saving factors with an entirely new forging process for Titanium. Result—C.S.I. offer precision-forged Titanium parts *at the lowest prices on the world market!*



CSI

Here are some of the characteristics of Titanium forged by the new C.S.I. process:

- Precision tolerances.
- Complete freedom from surface embrittlement due to gaseous contamination.
- Excellent surface finish.
- Greatly reduced machining costs—for example jet blade airfoils require polishing only.
- Consistent quality maintained.

Besides taking the lead in Titanium, C.S.I. is also highly skilled and experienced in the production of stainless steel and aluminum forgings—and in sand, permanent mould and die castings in aluminum and magnesium alloys.

CANADIAN STEEL IMPROVEMENT LIMITED

HORNER AND SECOND AVENUES, TORONTO 14, ONTARIO

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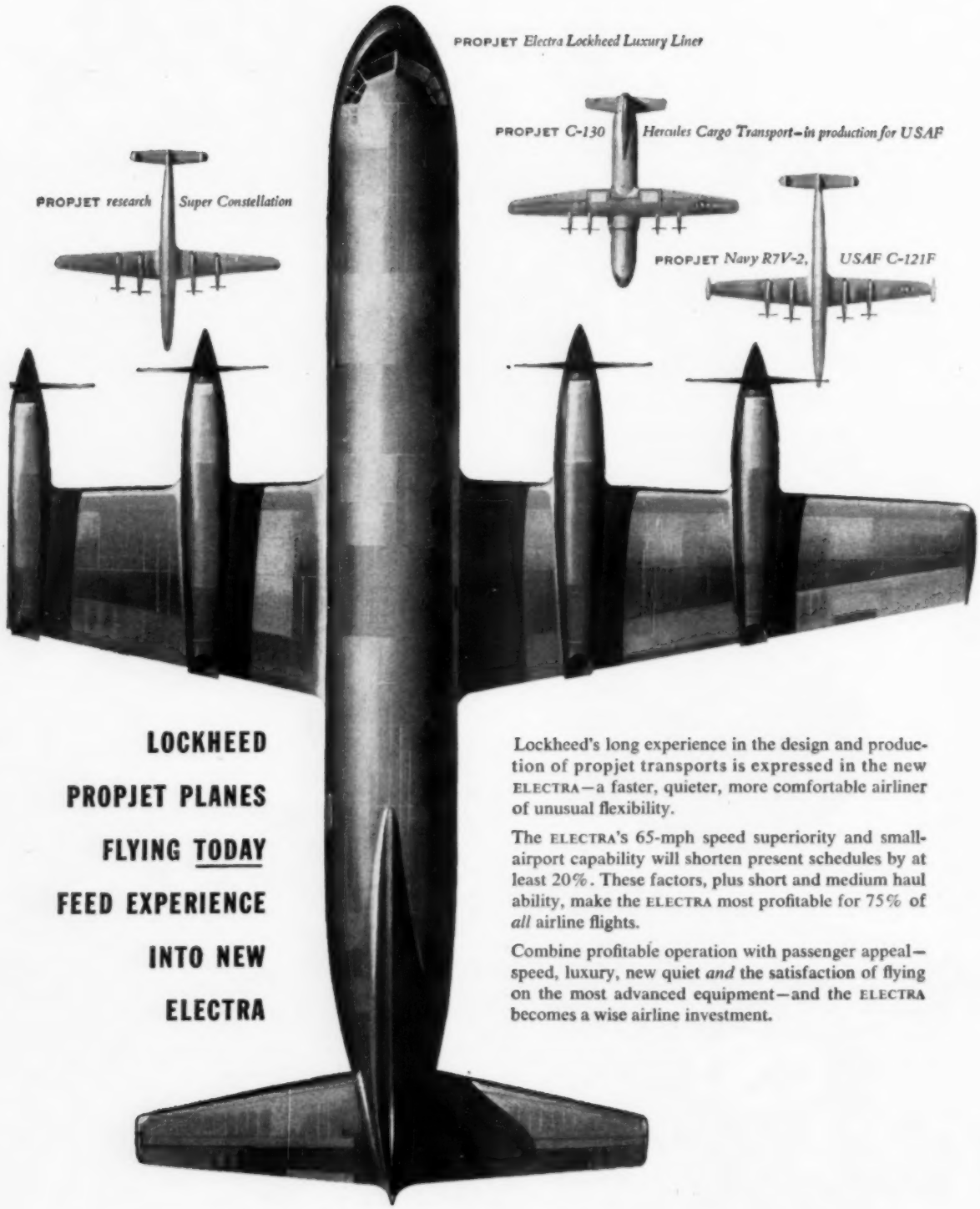

LOCKHEED PROPJET PLANES FLYING TODAY FEED EXPERIENCE INTO NEW ELECTRA

Lockheed's long experience in the design and production of propjet transports is expressed in the new ELECTRA—a faster, quieter, more comfortable airliner of unusual flexibility.

The ELECTRA's 65-mph speed superiority and small-airport capability will shorten present schedules by at least 20%. These factors, plus short and medium haul ability, make the ELECTRA most profitable for 75% of *all* airline flights.

Combine profitable operation with passenger appeal—speed, luxury, new quiet *and* the satisfaction of flying on the most advanced equipment—and the ELECTRA becomes a wise airline investment.

American, Braniff, Eastern, KLM Royal Dutch Airlines, National and Western Air Lines already have ordered 128 ELECTRAS for their important routes.

LOCKHEED

LOCKHEED AIRCRAFT CORP., BURBANK, CALIFORNIA WORLD'S MOST EXPERIENCED BUILDER OF PROPJET AIRCRAFT

JULY 16, 1956

AVIATION WEEK

VOL. 65, NO. 3

New York 36—330 W. 42nd St., Phone: LOngacre 4-3000 (Night LO 4-3035)

Editorial Offices Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630

Los Angeles 17—1125 West Sixth St., Phone: MAdison 6-9351

COVER: A trio of five-place 200-mph. Cessna 310 business planes directed by production chief test pilot Mort Brown poses especially for Aviation Week near the company's Wichita, Kans., factory. More than 350 of these light twins are serving U. S. and foreign industry; deliveries are averaging about one a day. A pilot evaluation of the 310 by Richard Sweeney begins on p. 50.

Picture Credits:
32, 33—Life Magazine; 33—CBS Television; 33—NBC Television; 61, 63, 67—Howard Levy; 77—Shipp.

64,983 copies of this issue printed

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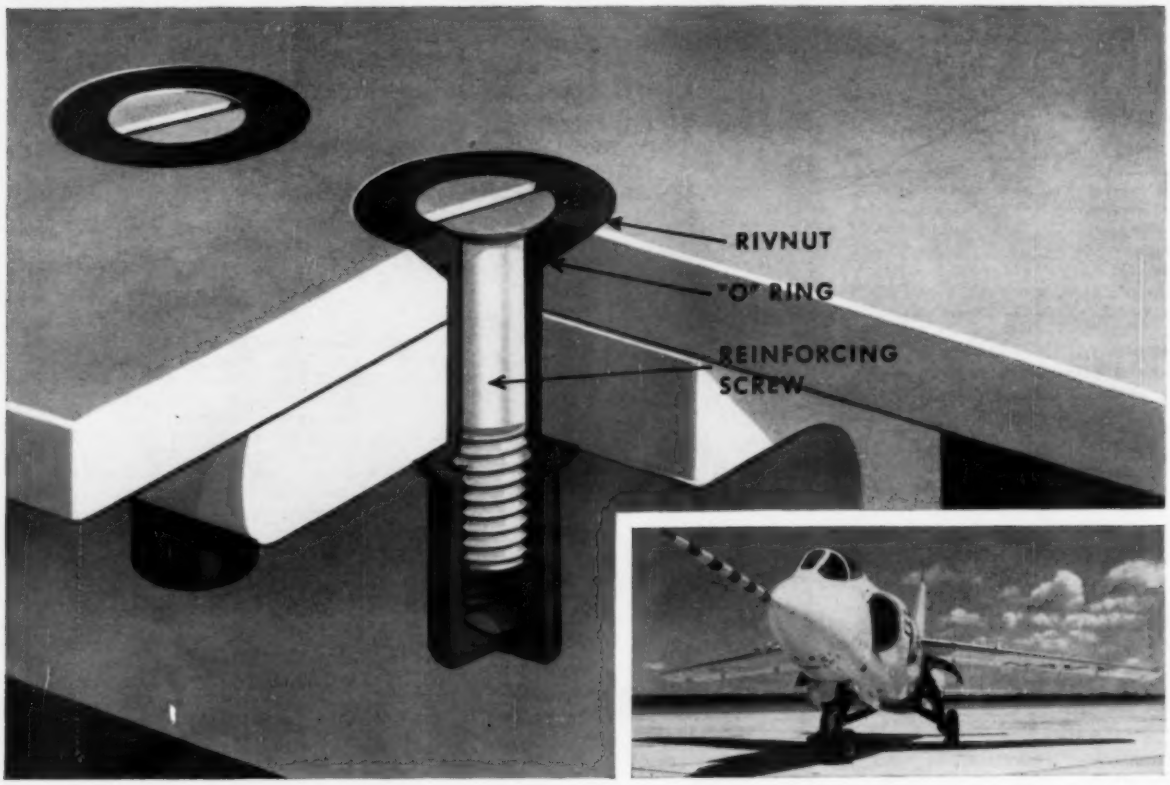
B.F.Goodrich



New Seal-Head Rivnut simplifies integral wing tank assembly

GRUMMAN ENGINEERS wanted to use integral wing tanks to stretch the range of their F11F-1 Tiger. Fuel tank walls would be the single top and bottom aluminum skin panels that form each wing. The problem was to find a blind fastener that could join the wing sections tightly enough to withstand the strains of supersonic flight and still prevent loss of fuel.

Working with Grumman, B. F. Goodrich engineers solved the problem by developing a Seal-Head Rivnut with rubber "O" ring, approved for primary structure. The cross section above shows how it works.

The new B. F. Goodrich Seal-Head Rivnut is a precision-ground steel fastener with high tensile strength. Installed in a drilled and countersunk hole, the Rivnut actually rivets the sections together. The "O" ring makes a fuel-tight seal and withstands temperatures from –65° to 225°. Then a special screw, available in tensile strengths up to 165,000 p.s.i., is screwed into the Rivnut to further reinforce and secure it against strain and vibration.

Whatever your fastening problem, there's probably a B. F. Goodrich Rivnut that can solve it. For more information, write: *Aeronautical Sales, B. F. Goodrich Tire and Equipment Company, a Division of The B. F. Goodrich Company, Akron, Ohio.*

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EDITORIAL

We Are All to Blame

The bureaucratic charade by government officials trying to fix official blame for the Grand Canyon mid-air collision that cost 128 lives is an unnecessary farce. It doesn't take an investigation by the Civil Aeronautics Board or a committee of Congress to determine what killed the crews and passengers aboard United Air Lines' DC-7 and Trans World Airlines' Super-Constellation.

The pilots and their passengers were victims of an antiquated air-traffic-control system and the combined industry and governmental apathy that has blocked any real progress towards establishing a modern federal airways system.

Blame for the Grand Canyon collision should be shared by almost every segment of the civil aviation industry, whatever the verdict of the CAB may be.

For example, what about Mr. Rowland Hughes and the Bureau of the Budget which he headed until Apr. 1? For the past three years the Budget Bureau has slashed every Civil Aeronautics Administration request for new electronic airways equipment. Only a few weeks ago, operating under the cloak of the Administration's security restrictions, the Budget Bureau forced a $15 million cut and prevented the CAA from requesting the full $55 million it needs to get even the first-year increment of its five-year airways improvement program started.

What about the Honorable Sinclair Weeks and his hatchetmen Robert Murray and Louis Rothschild, who, as Undersecretaries of Commerce for Transportation, have devoted themselves to squeezing money from CAA airways programs?

What about a succession of CAA administrators who have failed to tell the public and the Congress the truth about the growing crisis in air traffic control? What about their failure to organize any effective programs to build a modern airways system until late last summer?

What about the Congressmen themselves who have consistently voted to slash CAA airways budgets and who only this year voted the budget cut that disintegrated the Air Navigation and Development Board?

What about top airline managements who until recently were in favor of soft-pedalling the growing crisis in traffic control for fear it would frighten customers away? Would it have frightened customers as much as the 128 seared corpses on the bottom of the Grand Canyon? Or will it frighten them more than the similar tragedies that are bound to occur in high-density metropolitan areas before any remedies now proposed can be effective?

What about the airline pilots themselves? They have been one of the loudest voices raised in protest over the antiquated airways system and the lighthousekeeper's philosophy that dominated it. But did they shout effectively enough or back their protests by the kind of action that will force results?

Nor can the military escape their share of blame. Both the Air Force and the Navy have blocked progress immeasurably by cloaking their applicable developments in unnecessary military secrecy and by their reluctance to work whole-heartedly towards establishment of a truly common civil-military airways system.

AVIATION WEEK has raised its voice for over a year in warnings of the impending crisis and pleas for effective action to avert it. Last August 8 we cited the appalling statistics of the Air Transport Association "near miss" survey and the mid-air collisions already occurring during high-altitude operations of the Strategic Air Command. We wrote:

"A much more vigorous approach to the grave problem of air traffic control is necessary now if aviation is to avoid the tragic consequences of more mid-air collisions, economic strangulation of airline revenues and blunted efficiency of Strategic Air Command and Air Defense Command operations."

Again on October 10 we warned:

"Above and beyond all this endless debate and tortuously-slow progress lurks the twin spectres of a sieve-like air defense and mid-air collisions involving 40 to 60 passenger transports over heavily populated metropolitan areas that lie underneath the most congested air traffic centers.

"Ten year ultimate goal studies are necessary to keep pace with the rapid expansion of air traffic BUT THE AIR-SPACE CONTROL PROBLEM IS WITH US NOW IN A MOST DANGEROUS FORM. It requires immediate action along with future planning if we are to avoid the twin disasters cited above."

Yes, we shouted but, like the airline pilots, we are to blame too because we didn't shout loud enough or long enough to shatter official apathy.

Not until early this year when the blunt, accurate language of the Harding report scared Messrs. Weeks, Rothschild and Hughes on the traffic control system did the Eisenhower Administration begin to take this problem seriously.

The new CAA administrator Charles Lowen and his deputy administrator James Pyle are experienced pilots well versed in the dangerous shortcomings of the airways and air-traffic-control systems.

They have some sound ideas on how to tackle the problem for immediate action and long-range solution. But they will fall into the same snarl of bureaucratic red tape unless they are supported from the top down by the Eisenhower Administration and are at least allowed to ask for the funds they know they need to keep more people from being slaughtered in traffic-control accidents. They also will need support from Congress, the airline industry, the airline pilots, the military and the public if anything except more committee mumbling and inaction can be expected.

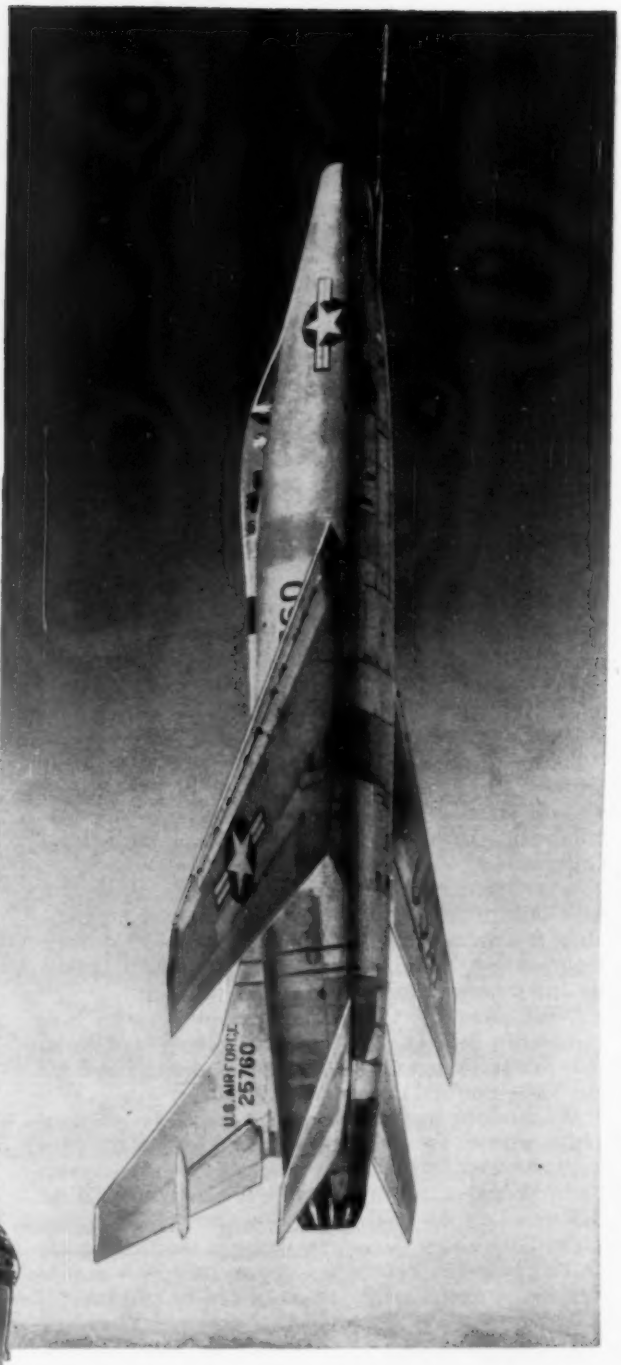
The current CAA plans call for spending $246 million for new electronic equipment over a five-year period. Virtually every type of equipment in the program is already available. Why can't the money be made available now so CAA can crank more safety into the airways in two or three years instead of five?

Why can't the Tacan-DME mess be settled so that the jet airliners of 1959 can enter into a stable, modernized traffic-control system instead of adding to the hazard?

HOW MANY MORE PEOPLE WILL HAVE TO BE KILLED IN MID-AIR COLLISIONS BEFORE THE GOVERNMENT AND THE AIRLINE INDUSTRY WILL TAKE EFFECTIVE ACTION TO MODERNIZE THE AIRWAYS AND AIR TRAFFIC CONTROL SYSTEM?

—Robert Hotz

The North American Super Sabre streaks for altitude at supersonic speed.



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WHO'S WHERE

In the Front Office

Lt. Gen. Elwood R. Quesada (USAF, ret.), board chairman and chief executive officer, Topp Industries, Inc., Los Angeles, Calif.

E. D. Wilgus, vice president-general manager, Aviation Developments, Inc., Burbank, Calif.

R. W. Ryan, executive vice president and director, Canadian Pacific Airlines. Also: **R. B. Phillips,** vice president-operations, and **H. B. Renwick,** vice president-sales and traffic.

Rear Adm. Wellington T. Hines, USN, BuAer general representative, Dayton, Ohio.

Frank J. Eberle, regional vice president (Miami, Fla.), Air Express International Corp., New York, N. Y.

Carl F. Schaefer, technical director, Norden Laboratories Division, Norden-Ketay Corp., New York, N. Y.

Walter P. Paepcke, board chairman of Container Corporation of America, a director, Continental Air Lines, Inc.

H. D. McRae, vice president-sales Pfahler Manufacturing Corp., Costa Mesa, Calif.

William G. Straube, vice president-general sales manager, IMP Engineering Corp., Hollywood, Calif.

Robert V. Werner, vice president-engineering, Cubic Corp., San Diego, Calif.

Brig. Gen. M. C. Woodbury, USAF (ret.), vice president, Aviation and Electronics Research Division, International Electronics Engineering, Inc., Washington, D. C.

Honors and Elections

H. M. Woodhams, managing director of Armstrong Whitworth Aircraft, Ltd., received the first Silver Turnbuckle Award from the Society of Licensed Aircraft Engineers, presented to individuals "upon the success of their careers and their overall service and contribution to the aircraft industry."

James H. Smith, Assistant Secretary of the Navy for Air, received the Distinguished Public Service Award for his outstanding leadership and contribution to naval aviation during his term of office (1953-1956).

Georges Glasser, president and director general, Sncaso, Paris, France, president of the Society of French Aircraft Constructors.

Changes

Joseph R. Pernice, managing director, Collins Radio Company of England, Ltd., Middlesex.

W. C. Hammond-Adler, European district manager (Geneva, Switzerland), Link Aviation, Inc., Binghamton, N. Y. Also: **Earl D. Hilburn,** West Coast manager.

Leighton R. Rickards, senior engineer, Mechanical Engineering Dept., United States Testing Co., Hoboken, N. J.

Capt. James N. Weir, chief of flight operations, British Overseas Airways Corp.

John C. Jack, Jr., assistant manager, service-sales dept., Southwest Airmotive Co., Love Field, Dallas, Tex.

Forbes Mann, program control manager, Chance Vought Aircraft, Inc., Dallas, Tex.

INDUSTRY OBSERVER

► **Bell X-2 is about ready for more high speed runs at Edwards AFB after modification of its Curtiss-Wright rocket engine nozzles to produce more thrust. Two new pilots are being checked out to fly the X-2 in place of Lt. Col. Pete Everest, who has made earlier high speed runs.**

► Convair's XB-58 supersonic bomber prototype has been completed at Fort Worth and rolled into the experimental hangar for final touches before taxi tests. The taxi tests are scheduled to begin in early August. XB-58 is powered by four podded General Electric J79 turbojets and features a delta-wing design.

► **Military needs for VHF frequencies for long-range radar may be the primary reason behind the recent proposal by the Federal Communications Commission to move present VHF television stations into the UHF band within the next 10 years. Announced reason for the proposed move was to ease the problems of UHF stations now attempting to compete with VHF operators.**

► Watch for the Soviet Union to increase the scope of its aircraft export program to barter jet fighters and transports for badly needed raw materials. U. S. S. R. already has supplied its satellites with both Ilyushin transports and jet combat aircraft. This type market makes a profitable dumping ground for obsolescing Soviet equipment and enables the Russian air force to phase in new combat types as fast as technically possible. The Soviet government now has large supply of MiG-17 fighters for barter now that the MiG-19 Farmer has become the standard first-line fighter type in the Red air force.

► **Wright Air Development Center has launched a major program for development of new avionic components capable of operating at temperatures of 500 degrees centigrade in the presence of nuclear radiation. Program should result in radically new component materials and techniques. Magnitude of the task can be seen from the fact that the components' industry required 10 years to raise top operating temperatures from 55 degrees centigrade to the present 125-150 degree limit.**

► Dr. Willy E. Messerschmitt, designer of World War II Germany's Me 109 and the jet-propelled Me 262, has designed a supersonic, delta-wing light fighter for the Hispano-Aviacion S. A. The Spanish aircraft will be known as the HA-300.

► **First underground military electronics factory in the U. S. may be built by the Army Signal Corps. The agency is at present negotiating with several major firms, including General Electric and the Radio Corp. of America.**

► A multi-billion dollar program to integrate and expand USAF's communications into an efficient, speedy "world-wide Bell system" will be launched by Rome Air Development Center. The program's scope and cost may outrank that of the SAGE air defense system.

► **Howard Hughes put pressure on Convair to change the name of its new jet transport from Skylark to the present Golden Arrow and to use gold-finish metal for the aircraft's exterior. Convair now uses the designation Model 880 for the transport.**

► Turboprop version of the Spanish transport, the CASA-207 Azor, will be built in Germany by Hamburger Flugzeugbau (Blohm and Voss) under a license contract with Construcciones Aeronauticas of Madrid. The transport, to be powered by two Napier Eland turboprop engines, will have a cruising speed of approximately 300 mph.

► **Aerojet-General Corp. has received a $133,936 Air Research and Development Command contract for research on ultra-energy fuels for rocket propellants.**

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WASHINGTON ROUNDUP

Congress Enters Talos Scrap

Under mounting Congressional pressure, the appointment of a non-military scientific board to evaluate the relative merits of the Army's Nike missile and the Air Force's Talos missile, both programmed for comparable continental defense missions, appears inevitable. There were these developments last week:

• **Conferees of both houses** agreed to an allocation of $16 million for Talos launching facilities in the $2.1 billion military public works authorization bill but stipulation was made that the money may not be appropriated without the approval of the House and Senate Armed Services Committees. The Senate committee previously had eliminated the $16 million "until the relative merits of both (Nike and Talos) systems have been positively tested and the roles and missions (of USAF and Army) clarified" (AW July 2, p. 30).

• **House Appropriations Committee** approved appropriations for Talos sites "to avoid any undue delay in the air defense build up" but directed the Secretary of Defense to "take immediate steps to appoint a committee of qualified experts, selected from outside of the military departments or private business enterprises which may be directly involved, to make an impartial and objective evaluation as to the merits and potentialities of the Talos and Nike missiles as defensive weapons."

Defense Information Channels

Department of Defense plans to set up a special panel for declassification of voluminous records on World War II and subsequent military operations and to appoint a special assistant to expedite the dissemination of scientific information "in the defense interest." These facts were reported last week by Robert Tripp Ross, Assistant Secretary of Defense for Legislative and Public Affairs, in testimony before the House Special Subcommittee on Information.

Ross said there are over 100,000 classified files on World War II alone, and that, with present personnel, a declassification review has "simply been mechanically impossible."

Committee members, however, were skeptical over two points made by Ross—that the Office of Information of the Secretary of Defense is the "sole agency" for the dissemination of defense information and that information to be released should be "constructive."

Under questioning by Rep. Dante Fascell (D.-Fla.), Ross conceded that if the military services do not choose to submit information, the Office of Information has no procedure for knowing about it unless a specific inquiry is made from an outside source.

"The channel for information release never gets any higher than the services—you don't see it if they don't want it released," Fascell commented.

Legislation Outlook

Congress is taking quick action on numerous aviation measures as adjournment nears. Among the bills:

• **Renegotiation.** The House Ways and Means Committee has approved extension of the act authorizing profits reviews of government business by the independent Renegotiation Board from Dec. 31, 1956, to Dec. 31, 1958. Final enactment appears certain. The committee recommended that firms with government business amounting to $500,000 or less annually be exempted. The present minimum is $250,000.

• **Airmail postage.** The House has voted, 217 to 165, to increase the airmail postage rate from six to seven cents an ounce, but there is little likelihood the Senate will act on the measure.

• **Aircraft Sabotage.** Congress has completed action on legislation authorizing the death penalty for willful sabotage of commercial, charter or company aircraft.

• **Independent CAA.** Sen. Mike Monroney (D.-Okla.), chairman of the Aviation Subcommittee, is optimistic that the full Senate Commerce Committee will approve legislation re-establishing the Civil Aeronautics Administration as an independent agency. The vote in committee, however, is expected to be close, and the legislation is not expected to go much further during the rush wind-up days of the session.

• **Alaska Airlines.** Both the House and Senate have approved legislation directing the Civil Aeronautics Board to grant permanent certificates to intra-Hawaiian and intra-Alaska airlines. The House, however, has balked at legislation directing permanent certificates for U.S.-Alaska service (Northwest Airlines' Minneapolis-Alaska segment and the Seattle-Alaska operations of Pacific Northern Airlines and Alaska Airlines). The Senate passed this measure, but, in view of the House position, it has little chance of enactment.

• **International Negotiation.** The Senate Commerce Committee has approved legislation requiring industry participation in the negotiation of bilateral international airline agreements eliminating the authority of the President in U.S.-territorial route cases and limiting it in international route cases to matters affecting the national defense and foreign policy. The prospect is for a presidential veto even if the measure should be cleared by the Congress.

• **Ministers' travel.** The Senate has passed legislation authorizing all air carriers to offer free or reduced transportation to ministers on a "space available" basis. A House-passed bill would authorize only non-subsidized carriers to make the offer.

• **Airline re-equipment.** The Senate, by a vote of 53 to 22, authorized legislation permitting subsidized air carriers to set aside earnings from the sale of equipment for the purchase of new equipment without having them considered as profits, which would reduce subsidy allowances. Sen. John Williams (R.-Del.) led a strong, but unsuccessful, fight against the measure (AW June 25, p. 25). With the support of politically influential local-service airlines, which operate into virtually every congressional district, the measure has a good chance of House passage.

Steel Strike and Defense

Defense Department is not immediately concerned about the possibility of the steel strike interfering with aircraft industry operations. The Commerce Department has ordered warehouses to reserve certain items, for defense industries. So far, the Air Materiel Command has not been able to complete a survey of its contractors, but the USAF is confident they can continue for some time despite the walkout. Defense is most worried about the supply of construction-type steel. These items are produced by the mills now out of operation and have relatively short lead times.

—Washington staff

Mass Airways Traffic Jam Snarls East

One of the worst tie-ups in airways history clogs New York traffic for 14 hours, Washington for 12.

By L. L. Doty

Washington—One of the worst traffic jams in airways history was reported last week by the Air Transport Association. The June 21 tie-up, which began at a single airport and then spread to every major airway in the Eastern U.S., clogged New York traffic for 14 hours, Washington traffic for 12. Effects of the tie-up were still being felt three days later.

The bottleneck was touched off in Washington by obsolescent control facilities and brought aircraft movement to a virtual standstill, although weather conditions were above limits, and air traffic volume was not excessive. Some of its far-reaching effects:

- **An estimated 30,000** passengers in the East and Midwest were forced to cancel travel plans.
- **One airline needed** three days to regroup its flight equipment and resume normal scheduling.
- **A delay of every flight** on its entire system was reported by another trunkline.
- **In New York, 4,754** American Airlines' passengers were delayed.

LaGuardia Hardest Hit

LaGuardia Field (New York) bore the brunt of the flight delays and cancellations, but no major airport east of the Mississippi escaped the chain-reaction of disrupted flight operations.

The big traffic jam began in the Washington sector with restrictions issued at 2:15 A.M. by Washington Air Route Traffic Control (ARTC).

The Washington order specified that, after 6:00 A.M., landing clearances at the Washington National Airport would be granted to but five aircraft from the New York area each hour. At 8:30 A.M., the quota was raised to six.

By 9 A.M., departures south and southwest out of the New York area were running 40 to 50 minutes late. The 11 o'clock quota of six landings an hour had been filled by 9:35 A.M.

From that time on, the situation developed into what American Airlines Vice President T. L. Boyd terms "the greatest fiasco I have ever heard about."

Between 7 A.M. and 5:30 P.M. American reported 49 flights delayed by a total of almost 70 hours. One flight was delayed three hours and 25 minutes. Twenty-one flights were delayed more than two hours.

American Airlines canceled 70 trips because of the New York-Washington traffic tie-up. The airline also reported that 2,794 of its passengers were delayed in departure, and that 1,960 passengers were left stranded because of the canceled flights.

One spokesman for the airline said: "Traffic jams did not result from airways or airports being saturated. Restrictions were issued before traffic existed, and the jam then developed on the ground while air-space was far from over-crowded."

VFR Weather

Weather at Washington was officially established as VFR (Visual Flight Rules). At 9:30 A. M., the ceiling was reported at 1,800 feet with broken clouds. Visibility was 10 miles.

The weather deteriorated slightly at 11 A. M. to 900 feet and six miles with rain, the weather's lowest ebb during the day. Although the weather had improved by 2:30 P.M., low scuds trapped some aircraft into flying IFR (Instrument Flight Rules).

The traffic problem in Washington was compounded by several factors, all of which point up the fact that the federal airways system has slipped into obsolescence. Three airports in the Washington area—National, the USAF's Bolling and Navy's Anacostia—are in such close proximity they are considered as one airport for traffic control purposes.

Approaches from the north are without ILS. Furthermore, aircraft landing from the north at Bolling or Anacostia, both of which are less than a mile from National, are forced to follow an approach slot that takes them directly across National Airport. Thus, traffic for all three airports must be relayed into the airport as though there was only a single runway to handle all flights. This is known locally as the "Georgetown approach."

There is no such criss-cross approach pattern to delay incoming flights from the south. The ILS unit at National Airport permits ILS landings at close intervals from the south, since aircraft using Bolling and Anacostia can bleed off ILS system in approaches.

On June 21, winds between 7 A.M. and 4:30 P.M. were south to southwest ranging in velocity from three to 12 miles per hour. As a result, National Airport traffic was backlogged by Bolling and Anacostia aircraft using the "Georgetown approach." At one point, Washington Air Route Traffic Control was accepting landings at 30 minutes separation between aircraft on all runways at all airports. IFR approaches were made through the use of the terminal visual omni-range.

Milton Arnold, ATA vice president, recently testified before a congressional subcommittee that no two airports should be located within twenty miles of one another if efficient operations were to be expected. Arnold also asked for dual runways, dual ILS systems and high-intensity approach lights.

Passenger Jams

As traffic awaiting clearance into Washington log-jammed, the airlines made every attempt to keep their passengers posted. At times this was impossible. Capital Airlines, whose experience was typical, reported that "we were unable to get sufficient information to keep the company informed."

A Capital spokesman, who called June 21 "the worst (day) in our history," added:

"It was the only time that every single flight on our entire system was affected."

The futility of keeping passengers up-to-date on plans is exemplified by Capital's experience with flight 145 scheduled to leave LaGuardia at 11:00 A. M. for Pittsburgh and Chicago. The airline was advised at 10:30 A. M. that the flight would be delayed because of airways traffic. At 11:30 A. M., word was received that the delay would continue for another hour and 45 minutes. By noon, the delay had been set at 2:30 hours. It was reduced to 2:20 hours at 1:00 P. M.

Capital imposed inconveniences on a large number of passengers; the air-

Burke Funds Requested

Washington—President Eisenhower asked Congress last week to vote $34.7 million to begin construction of a commercial airport at Burke, Va., to serve as an alternate for Washington National and help relieve airways congestion around the nation's capital.

The Burke airport, first recommended in 1949, has been consistently opposed by the Maryland congressional delegation. The delegation hopes to have Baltimore's International Airport designated as the Washington alternate. Burke, however, has the endorsement of the Senate Commerce Committee.

The President's request would provide funds for the acquisition of land and construction of two north-south runways, one 8,000 feet long, the other 8,500 feet; a 7,000-ft. east-west runway, a largo terminal building and an access highway to the airport.

line load factor for the day was 65%.

Trans World Airlines delayed 27 flights out of LaGuardia for an average of almost one hour for each trip.

Harold Hess, manager of TWA's flight planning and dispatch for the company, said:

"June 21 is the latest case where ARTC flow control operates in fits and starts with no accurate information available to the airlines so that they can plan anything like intelligent operations."

The troubles on June 21 had begun to mount at a rapid pace by noon. Washington ARTC asked that all aircraft enroute to Washington be separated by 30 minutes "regardless of altitude." Delays of inbound flights at LaGuardia bounded to 60 minutes.

Jet Blocks Traffic

Approach traffic at LaGuardia was stopped at 12:27 P.M. after one aircraft reported communications difficulty. It was resumed shortly thereafter, but all traffic was called to a 40 minute halt in Washington at 1:30 P.M. by a jet trainer requesting an early clearance.

The jet was equipped only with VHF (VOR) and metropolitan airports at Washington are not fully implemented with this equipment. This fact, tied-in with a low fuel supply, necessitated special handling of the jet.

New York Air Route Traffic Control announced at 2 P.M. that radar departure service was no longer available; radar scopes were showing too much precipitation to be effective in traffic control. At this point, flights into Idlewild were being delayed by 50 to 70 minutes.

Approximately 95% of all Eastern Airline flights scheduled between 8 A.M. and midnight encountered delays. F. A. Stone, Eastern's director of flight operations, later urged that steps be taken "to correct accumulated delays which are placed on us by arbitrarily closing out or limiting flights into the New York-Washington area because of borderline weather."

Washington weather at 2:27 P.M. was 1,700 feet and seven miles. At 4:27 P.M., it was reported at 4,000 feet and seven miles with the wind shifting to west-southwest. Rerouting of traffic from the Georgetown approach to ILS was considered, but the wind velocity of six miles an hour was felt to be too strong to permit the switch.

At 4:13 P.M., Washington ARTC was again restricting New York flights to five per hour (earlier, it had been increased to six). However, landings at the New York airports were being sped up. Delays at LaGuardia, Newark and Idlewild were reduced to as little as 15 minutes.

It was some 30 minutes later that Washington ARTC canceled all outbound restrictions and, five minutes after that, all Washington restrictions were lifted. New York ARTC restrictions were not removed until 8:31 P.M.

Resumption of normal operations did not spell the end of delayed flights. Turn-around equipment at airports in New Orleans, Minneapolis-St. Paul, Memphis, Jacksonville, to mention a few, began return trips to New York and Washington two and three hours late. Passengers fortunate enough to hold reservations on uncanceled flights were seldom aware of the time they would be delayed.

June 21 was not an abnormal day. Traffic was not unduly heavy. The Washington area handled 806 airplane movements on this day, of which 655 were treated as instrument traffic. On the two previous days, 924 and 953 movements were handled respectively.

Commercial aircraft flights into Washington on June 21 totaled 582. Military airplanes numbered 155, and civil airplanes amounted to 155. On the previous day, the totals were 704 commercial, 112 military and 98 civil.

Bottleneck on Ground

The bottlenecks occurred on the ground. Airways were never overcrowded and separation far exceeded that required for safety margins.

ATA's Milton Arnold pointed out that "here in the U.S. in order to guarantee the safety we require, an aircraft which is tens of feet in breadth and length when on the ground must often have an airspace ten miles wide and fifty or more in length assigned to it in flight. This excessive space allocation is an outgrowth of communication and coordination lags, plus lack of accurate, up-to-date aircraft position data at the controller's operating location."

Interruptions of traffic flow because of emergencies are not common but must be considered inevitable in any airways system. Neither the disabled aircraft at LaGuardia nor the jet trainer asking prompt clearance at Washington was so unusual as to be the primary cause of the over-all traffic jam.

Why the Jam

Lack of a dual ILS in the Washington area was a major contributing factor to the poor showing on June 21. Traffic volume can be expected to drop by 30% at any time the Georgetown approach is used.

A representative of ATA's Air Navigation Traffic Control Section said his group is not willing to point an accusing finger at any one ARTC unit for the June 21 fiasco. Rather, he said, the entire federal airways system must be condemned. He added, "If any cause beyond that is to be used, lack of coordination between the New York ARTC and Washington ARTC is as good as any."

This statement echoed a point raised recently by William B. Harding, who headed the Aviation Facilities Study Group set up by President Eisenhower. Harding said: "The volume of aviation activities has grown to such a size that the use of airspace, and the facilities required for its use, have to be centrally planned and directed."

CAA Issues First Study Report On '100 Problems' of Jet Age

Washington—The Civil Aeronautics Administration last week issued its first quarterly report of studies it is conducting on the "100 problems of the jet age."

The progress report, an informal and brief summary of findings by the CAA Jet Planning Group, implied that no radical changes in present operating methods would be required for the introduction of jet transports. Some of the highlights of the report:

- **An increase in runway** width from 150 feet to 200 feet was proposed. The need for increasing runway lengths will be determined when more is known of jet transport performance. Arresting barriers at runway end were advocated.
- **Jet transports can be handled** through normal traffic patterns. It is not expected that such aircraft will be forced to hold at high altitudes.
- **Jet transports** will not require priority in takeoff or landing. It was proposed, however, that any airplane ready for immediate takeoff be allowed to bypass aircraft running up.

The report emphasized that many of the problems being considered by the group are not peculiar to jet transports. Exceptions brought out were of a minor nature. For example, the aerodynamic drag of the protruding type of antenna was analyzed.

Flush-mounted antennas were suggested as an alternative to the standard design. The report also mentioned a system whereby a section of the wing or rudder is electrically isolated as an area—for VOR antennas. Aircraft equipped with airborne radar could carry the VOR and glide slope antenna in the radar nose above the radar antenna.

Fuel standardization was considered undesirable. The group said there was

no need for restricting fuel types since engines can be qualified for more than one type.

The CAA will require that all jet transports demonstrate rapid descent capabilities in the event of sudden cabin depressurization. Type certification will be withheld unless high-altitude aircraft are equipped to meet any emergencies resulting from explosive decompression.

Because of higher flight levels required by jet transports, high-altitude VORs are now under consideration. The CAA plan calls for VOR transmitting distances of 200 nautical miles at altitudes between 20,000 and 75,000 feet. Approximately 50% of VORs in the U. S. now provide coverage up to 40,000 feet; their range at this altitude is approximately 115 miles.

To ease congestion in the communications band, the CAA has taken an initial step from the present 200 kc to 100 kc channel spacing. As soon as practical, this move will be followed by 50 kc channeling of the band.

The report said traffic at high altitudes will operate in controlled airways. A high-altitude route structure is being worked out in conjunction with the military and airline industry, and the report anticipates further advances in this field when control of all airspace above 29,000 feet is undertaken during 1957.

Damage to runway and taxi-strip surfaces from jet heat blasts is not considered a problem because of the outward, rather than downward direction of the thrust. Also, since no engine run-up is required as jets swing onto runways, heat dissipation is rapid.

Jet fuel spilled on Portland cement concrete pavements, however, has a dissolving action. On asphaltic concrete pavements, the fuel produces a softening effect which may result in rutting under wheel loads.

Paints now used for runway markings do not stand up against heat or fuel spillage. A plastic paint is under development to withstand the action of jet engines but it has not been able to hold color after repeated applications of heat. The CAA will study the merits of a hot extruded plastic marking.

For normal operations, the group does not anticipate a need for blast fences. It said, however that the fences would be valuable at maintenance and service areas and as a protection to buildings and populated sections.

A substantial increase in fuel storage capacity was forecast by the group. It recommended that the storage problem be studied jointly by the Air Transport Association and the American Petroleum Institute. The group wants ATA to determine capacity needs and the API to assist in the development of systems and equipment.

In a survey of safety, the group learned that interest in rear-facing seating configuration is waning, particularly among foreign operators.

Jettisoning of fuel also was considered. Because of the low volatility and the large quantity of fuel that may be dumped to reduce weight for an emergency landing immediately after takeoff, it was urged that minimum altitudes be established for such procedures.

The group also advised non-passenger service tests on all new aircraft before introduction into regular air carrier service. Scheduled cargo operations were suggested as a service testing means.

Satellite of Magnesium

Brooks & Perkins, Inc., received a U. S. Navy contract last week to manufacture the satellites for Project Vanguard. The Detroit company will fabricate the earth satellites from magnesium. Thirty-five satellites of two sizes—six and 12-inch diameters—are to be manufactured for launching during the 1958 International Geophysical Year (AW July 2, p. 23).

Lockheed U-2 Makes Data Flights

Washington—Lockheed's recently-announced U-2 flying test beds (AW May 7, p. 32) already are conducting high-altitude data flights from the Atomic Energy Commission's Watertown Strip, Nev., and a USAF base in Lakenheath, England.

The subsonic aircraft, believed to be of thin, straight-wing design, are paving the way for future jet airline operations by testing the effects of gust loads at 50,000 ft. and above.

Specific research goals include more-precise information about clear air turbulence, convective clouds, wind shear and the jet stream.

In addition, the aircraft are collecting information concerning cosmic rays and the concentration of certain elements that appear in the atmosphere, including ozone and water vapor, at the request of the Air Force and under the direct supervision of the National Advisory Committee for Aeronautics.

In all probability, the Watertown Strip aircraft is also probing atomic fallout and its effects.

Dr. Hugh L. Dryden, NACA director, said last week that the research aircraft already have proved their value in the "relatively few flights" they have made thus far. There are believed to be a total of three U-2s now in operation, and the program eventually will be extended to cover other USAF overseas bases.

The aircraft is recording turbulence data on especially-developed instruments furnished by NACA and the Wright Air Development Center. They include:

• **VGH recorder** developed by NACA with two pressure sensitive elements for continuously measuring indicated airspeed and pressure altitude, a galvanometer element for measuring the output of a remote acceleration transmitter and a timing mechanism. Each element rotates a mirror that, in turn, moves a reflected lamp image across the recording medium, a 200-ft. roll of 70 mm. photographic paper.

• **Sensitive airspeed recorder** similar to the VGH but capable of obtaining a high sensitivity factor for airspeed through the use of multiple mirrors.

• **NACA VG recorder** that scribes an envelope of acceleration against airspeed on a smoked glass plate.

• **Turn meter** designed by the NACA that records optically on a 50-ft. roll of photographic film and records the aircraft's rate of pitch.

• **Turbulence recorder** developed by the Wright Air Development Center. Known as Flight Recorder Model BB, the instrument records indicated airspeed, pressure altitude and normal acceleration on arc-sensitized paper.

Improved equipment scheduled to be added to the U-2 once development work is completed include an infra-red hygrometer for accurate measurement of dew point, an improved vortex temperature probe, a vortex psychrometer for measuring true free air temperature and relative humidity, instruments for measuring visibility and turbulence measuring and recording equipment.

True free air temperature will be measured by the U-2 through the use of a vortex thermometer system (ML-470 AMQ-8) developed by the Naval Research Laboratory. The system is capable of measuring free air temperature with an accuracy of ½ deg. C.

Indicated free air temperature and indicated relative humidity will be measured with a temperature-humidity measuring set developed by the Evans Signal Laboratory, Belmar, N. J. The system has a recovery factor of approximately .87, a precision thermistor for measuring temperature and a carbon strip for measuring humidity.

Pressure altitude will be measured by a precision pressure transducer.

Both the temperature-humidity measuring system and the vortex thermometer have been modified to connect their electrical output into a KS-4 Aerograph system for automatic recording.

Missile-Bearing Helicopters Proposed

By Claude Witze

Washington—Development of missile-bearing helicopters is being proposed for the U. S. Army as part of its program of increasing mobility with "airphibious" artillery.

At least one manufacturer—Doman Helicopters, of Danbury, Conn.—has demonstrated a stripped-down combat version of a helicopter for use as an aerial firing platform for rockets, bazookas and machine guns. A regular version of the aircraft, the Doman YH-31, was first delivered to the Army for service tests about two months ago (AW May 14, p. 31).

Studies conducted at the Artillery and Guided Missile School at Ft. Sill, Okla., have centered around the Sikorsky H-19 and H-34 configurations as well as the tandem Bell HSL.

Recoilless rifle and eight-inch guided artillery missile armament has been proposed for the smaller aircraft. Designs have been made for installation of launchers to house the 20-inch guided artillery missile and the Honest John on the tandem helicopter.

Basic concepts of the designs are described in the Army Aviation Digest by Col. Charles W. Matheny, Jr., assistant director of the Department of Tactics and Combined Arms at the Ft. Sill school. Col. Matheny says in part:

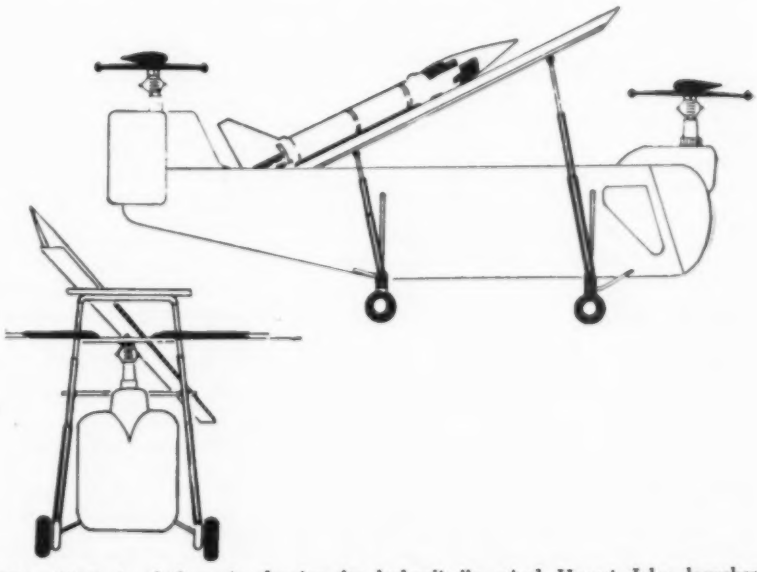
"It is unmistakably evident that our Army will soon have airphibious tactical units, with aerial vehicles replacing ground vehicles. This will enable troop units to operate on the ground but move through the air. These airphibious units will range in size from infantry and artillery battalions to whole divisions, and they will move through the air in their own helicopters."

Col. Matheny's experimental "airphibious artillery regiment" would be equipped at the outset with the 105mm. howitzer modified to reduce its length and bring the total weapon weight down to 3,000 lb. A lifting eye would be provided to facilitate hauling the howitzer with a helicopter sling.

The colonel's table of organization calls for the regiment to have 61 officers, 298 warrant officers, 827 enlisted men and 188 helicopters. The helicopters would be divided into 43 reconnaissance aircraft, 42 utility helicopters, 44 one-and-a-half-ton helicopters and 59 three-ton helicopters. The regiment would have a headquarters unit and three artillery firing units.

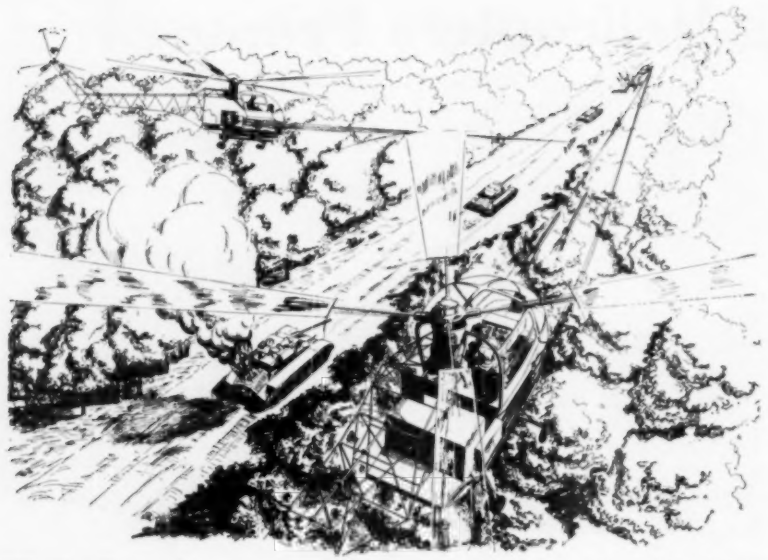
In an estimate of probable costs, Col. Matheny discounts heavily the idea of depending upon Air Force fixed-wing planes to move an artillery regiment with its 18 105 mm. howitzers. In this

DOMAN YH-31, panels, doors, windows, superstructure removed, has simulated bazooka.



BELL HSL-1 is platform in drawing for hydraulically raised Honest John launcher.

LAUNCHER for 20-in. guided artillery missile is suspended on side of HSL-1 model.



SIX .50 caliber machine guns—three on each side—and six rockets beneath fuselage are mounted on helicopter in Doman concept of tank battle of the future.

operation, only 643 men would be required in the artillery unit, but the Air Force would need an estimated 49 Fairchild C-123 assault transports and 46 Douglas C-124 transports to move it. Cost, he says, would be more than $166 million.

For an airphibious artillery regiment, however, the total of 188 helicopters would require an investment of only $38.6 million though the personnel strength is raised to 1,184, including the helicopter crews.

Cost Equalizer

Col. Matheny points out that the helicopter does not need roads or airports, which add to indirect operating costs. He adds:

"A helicopter costs more than a truck . . . but, when all the cost factors concerned with land combat operations are considered, helicopter transport may be found more economical than either vehicle or airplane transport."

Advantage of the airphibious artillery, of course, would be in the speed and flexibility with which it operates. Col. Matheny lists these capabilities:

- **Airphibious artillery can** occupy positions inaccessible to units bound to ground transport and areas surrounded by the enemy.
- **It can eliminate** vehicle tracks that could betray the location of artillery.
- **It can move sensitive** communications or electronic equipment with minimum damage.
- **It can move swiftly,** with smaller danger of detection by the enemy, cutting to a minimum the time exposed to enemy fire.
- **It can operate** in mountain, arctic and jungle territories.

Col. Matheny also argues that the helicopters used by an airphibious artillery firing unit has other utility for the Army. The aircraft can, of course, serve as a light transportation helicopter company and still retain its capability for normal firing operations.

On the subject of economy, one that the Army has emphasized in its effort to improve the helicopter outlook, the Ft. Sill school expert holds that maintenance costs are being lowered and will continue to go down. Cargo capacities, he predicts, may increase until they exceed that of the truck.

"Conditions of air superiority," he continues, "do not affect helicopter transport any more than they affect truck transport, and experience probably will show that helicopters are much less affected than trucks."

On the subject of helicopters as vehicles for artillery missile launchers, Col. Matheny says:

Helicopter Missile Launcher

"It is certainly feasible to develop an artillery helicopter self-propelled missile launcher for the Honest John and other new types of missiles. . . ."

He suggests that some of these units should be redesigned to make them light enough for helicopter transport.

In the Doman effort, panels, doors, windows and superstructure were removed from the YH-31 helicopter to make the combat version. It took two men four hours to do this job, removing 350 lb. in weight from the aircraft.

Doman says the stripped helicopter makes a stable firing platform with a minimum silhouette.

In one version, it is armed with six 50-caliber machine guns, six rockets.

Argentina Looking For Modern Aircraft

Buenos Aires—Argentina, since the overthrow of Peron, appears to be waking up to the need for more modern aircraft.

During 1946-48 this nation spent $30 million on plane imports, $11.5 million of which went for transport planes for the Flota Aerea Mercante, now part of the Aerolineas Argentinas. But today the country's flying stock, both military and civil, is rapidly approaching obsolescence. Whole fields of civil flying, such as those of agriculture, and air taxis and ambulances, are completely undeveloped.

All this, air officials here feel, makes this country a market worth taking into account. England, they say, has once again understood this fact and made immediate offers with good facilities for payment over a long term. Among offers already received by the Air Ministry are those for the Gloster Meteor Mk-7 and 8, DH Vampire trainer, and Chipmunk Mk-20, English Electric Canberra B-8, Percival's Prince and Pembroke.

Canadians have come forward with the prototype Sabre Mk-5 equipped with Orenda turbines. France is interested in selling the Dassault Mystere, as well as the Fouga Magister 170R training plane, the Morane-Saulnier 760 Paris, the Noratlas 2501 cargo plane and the light, low-priced Djinn jet helicopter. The Italians have offered their Fiat G. 80-3B, and the Swedes their Saab 32, equipped with Rolls-Royce turbines.

Russians and Americans, however, have made offers whose prices differ from those current in the world market. Russia has offered planes for civil aviation at a very low price, the Argentines say. What types were offered is not stated. The Americans on the other hand are said to have offered, among others, the Beechcraft 34-B, the Temco T-35, and T-28C and Republic's Thunderstreak F-84F, all at "extremely high prices."

If this price difference between the U.S. product and its competitors continues, it is very probable that Argentina, like almost all the rest of the continent, will continue operating with the C-47 and the C-54. In any future Argentine military or commercial aircraft buying, strategic concepts also will be taken into consideration.

Negotiations are under way, however, to re-establish the U. S. Air Mission here. The government also has asked the United States for officers to act as teachers at the General Staff School, and it hopes shortly to send Argentine officers to the U.S. for advanced training courses.

Twining Says Russia Can Surprise West

Washington—Gen. Nathan F. Twining, USAF chief of staff, declared last week that Russia is "progressively narrowing" this country's technological lead and may surprise the West with new weapons.

In a report before the Senate Armed Services Committee on his recent trip to the Soviet Union for the June 24 air show, Gen. Twining said he had seen evidence of rapid Red aeronautical advance in these fields:

- **Thorough technical training** of large numbers of selected personnel.
- **Widening variety** of aircraft under development, including air-to-air refueling capability and advanced combat types of Russian design.
- **Improvement of western jet** engine designs and development of more powerful Russian engines.
- **Rapid progress** in research and development.

Following his report on Capitol Hill, the general was questioned by the committee in closed session. According to one senator, he announced his approval of the previous week's action by Congress in approving an additional $900 million for USAF's Fiscal 1957 budget (AW July 9, p. 29). The move was opposed by the Eisenhower Administration in general and Defense Secretary Charles E. Wilson in particular.

Gen. Twining emphasized that continued heavy investment in research and development is essential if the USAF is to maintain its leadership in quality.

Soviet Capability

On the basis of what he and his party of Air Force officers saw at the Tushino and Kubinka display (AW July 2, p. 26), Gen. Twining gave the Senate these comments on Russia's aeronautical capability:

- **High level of Soviet scientific** and engineering talent is reflected in the wide variety of modern aircraft now being pioneered.
- **Despite "undeniable strides** . . . they have not outdistanced us. Nothing is superior to the best U. S. aircraft in comparable categories. In some areas, such as development of the turboprop Bear bomber, Russia has made an effort in a field that we choose to ignore."
- **Some advanced Russian aircraft** appear to need further test and development before they can be put in production. Soviet designers, like those in the U. S., are having stability problems at high speeds.
- **Increased variety** of aircraft indicates "a broad understanding of the state of the aeronautical art and of Soviet determination to advance therein on a very wide front."

In total, the general reported, his party saw ten Russian planes that are new or represented modifications of designs already known to the West (AW July 2, p. 26). The most important of these, he said, was the twin-jet light bomber that appears to be a replacement for the Il-28 Beagle. The new aircraft has been given the code name "Blowlamp" by the Air Force.

Among other new planes noted by the party were the MiG-19 Farmer, a fighter, and two new models of the all-weather Flashlight designated the Yak-25. Gen. Twining said the USAF party inspected the interior of the twin-jet Tu-104 transport but was not permitted to see combat planes at close range.

Soviet Refueling Ability

At Kubinka, Gen. Twining said the Americans saw evidence of Russian interest in aerial refueling—a 50-ft. length of hose stretched between the wings of two Badger jet medium bombers.

"It was obvious," he added, "that the Soviet air leaders are giving a good deal of thought to the air refueling problem. A Soviet air general informed us that the Russian air force is working on what he described as two different approaches—a flexible system and a so-called 'rigid' system." These probably are somewhat similar to the U. S. probe-and-drogue boom systems.

Secretary Wilson recently told a Senate Armed Services Subcommittee that U. S. intelligence had no indication that the Russians have a tanker fleet.

Gen. Twining said that, from conversation with Soviet leaders, he received "the distinct impression that they are wide-awake to the advantages of aerial refueling."

He said the Russians cited figures on the possible extension in range, and it was obvious refueling will be "an essential Soviet objective."

U. S. experts interpreted Gen. Twining's description of the Russian refueling apparatus as a type that feeds fuel from the wingtip of a tanker into the wingtip of a combat plane by the probe-and-drogue method. The device has been tried in the U. S. but was not popular with pilots who had difficulty making the connection. A four-inch hose indicates that the Russian system has an exceptionally high rate of fuel transfer.

No Missiles Seen

On the subject of missiles, General Twining said the Americans did not see or hear anything. He said the Reds maintained a veil of secrecy and would not be drawn into conversation on the subject.

Most interesting part of his visit to Russia, Gen. Twining said, was a day at the Zhukovskii Air Engineering Academy in Moscow, where 2,500 Soviet air force officers are enrolled for a five-year course. The fact that they could spare so many officers from operational duty impressed Gen. Twining, whose own air force faces a continuous personnel problem.

The general said the instructors at Zhukovskii "knew their business" and had a quantity of "good" and varied equipment. There was, he said, an unusually fine collection of laboratory cameras for high-speed work and the metallurgy department would compare favorably with the highest U. S. standards.

A Mach 3 wind tunnel was demonstrated at the academy, using a model that was a true delta design. The variety of delta models on exhibit, the general said, "indicated that Soviet research studies are reaching beyond the limits suggested by the intermediate delta prototypes that were flown at Tushino."

The academy has another wind tunnel which the Russians said could produce Mach 5 conditions. It was not demonstrated, however.

The academy also had cut-away versions of Soviet axial-flow jet engines that

'A Peaceful People'

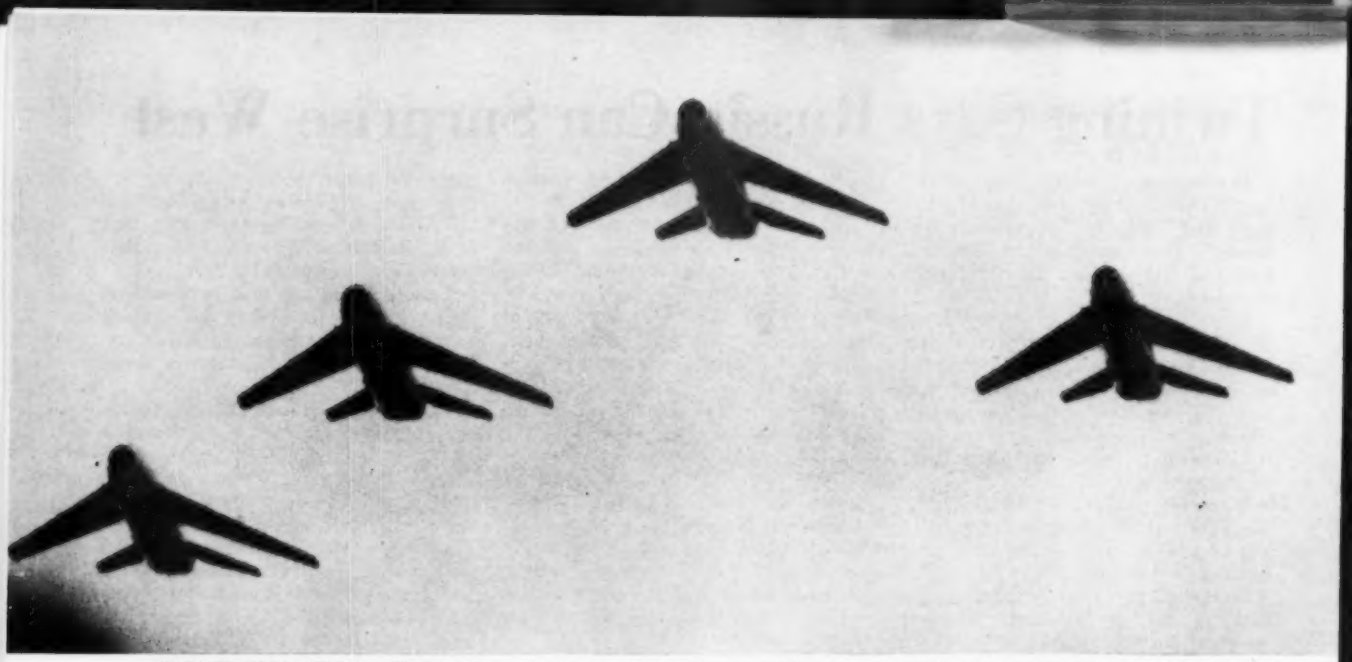
Washington—Gen. Nathan F. Twining, USAF chief of staff, reports that his trip to Russia was carefully controlled by his hosts to make sure that the American party saw only a limited amount of the Soviet capability.

"Though the welcome mat was laid out," he said, "a careful hand was kept on the door."

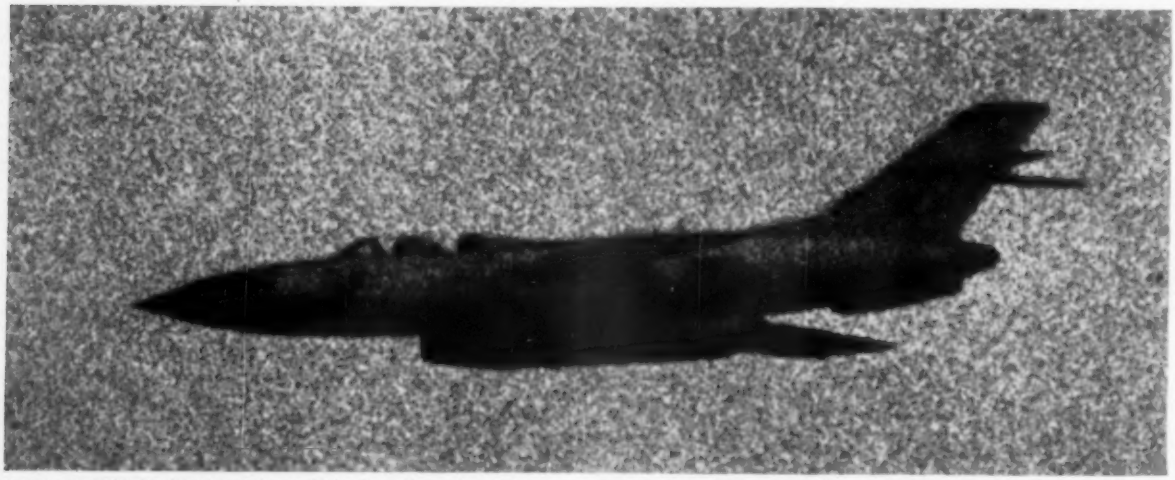
Shown through outmoded aircraft and engine plants after seeing modern planes in the sky seemed inconsistent to the USAF party. Gen. Twining said this was mentioned to Andrei Tupolev, Russia's leading aircraft designer, who replied: "You have to keep something in your pocket, you know."

Commenting earlier on the small number of bombers flown in the Tushino air show, an American officer asked why more were not displayed. Marshal Zhukov gave the answer this time:

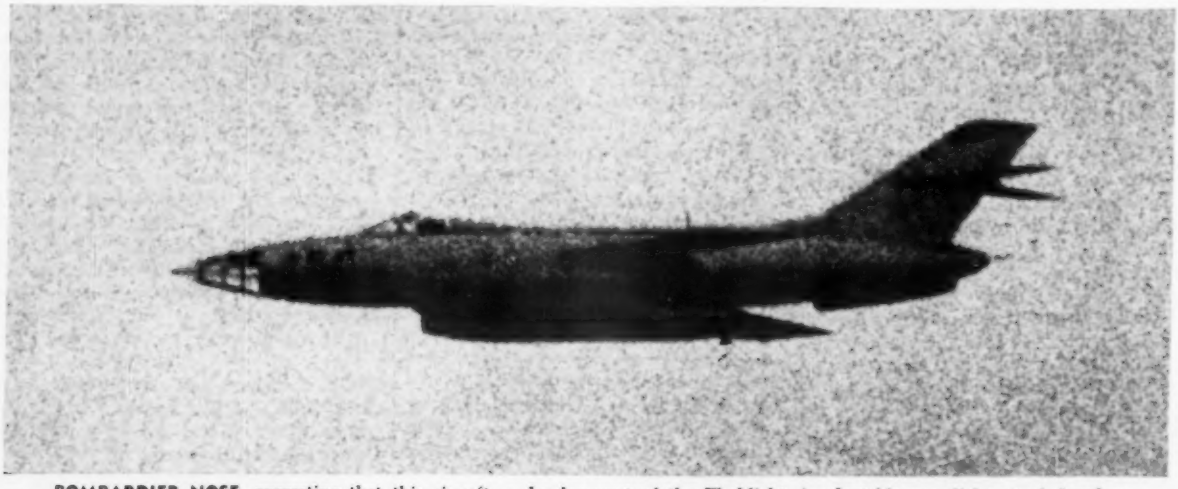
"Oh, they are in production, but we are a peaceful people. We do not want to boast about our offensive weapons and offensive capability."



FARMER FORMATION at Tushino fly-by clearly shows twin tail pipe configuration and split inlet for two engines. High degree of sweep back



SLEEK FUSELAGE LINES of latest Yakovlev all-weather fighter are caught in pictures which show sharply pointed radome and . . .



. . . **BOMBARDIER NOSE,** suggesting that this aircraft, a development of the Flashlight, is adaptable as a light attack bomber.

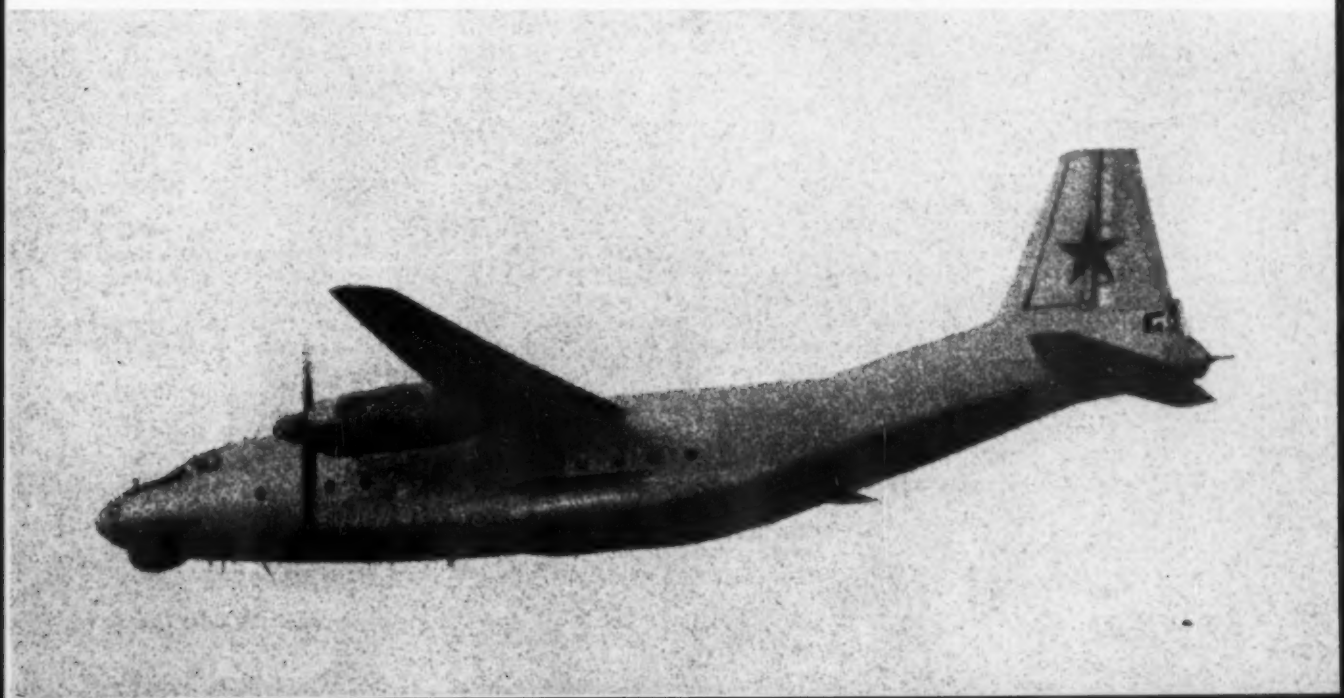
sweep back is masked in this head-on photograph.

Latest Russian Aircraft Display Design Details

ONE OF THREE DESIGNS credited to Sukhoi, this has partial delta wing, high wing fences set at least halfway out from fuselage, and variable area inlet.

SUPER FARMER with sharp sweepback, resembles ordinary Farmers, but is noticeably larger.

ASSAULT COMBAT TRANSPORT designed by Antonov, has gunner in enclosure above defensive tail turret. It has two turboprop engines.



were more advanced than the ones seen in production on the party's tour of an engine factory. Although the Americans were not shown any developments in this field, they were told by designer Andrei Tupolev that the Bison heavy bomber is equipped with axial-flow engines. The Bison power units are more powerful than any displayed at the academy.

At a second school, the Monino Air Academy, the party had a glimpse of how the Russians train young officers in a three-year course on operations, tactics and doctrines of air warfare.

Featured at the school was a training layout demonstrating an air attack on a navy (presumably U. S.) carrier formation. The school also had models of the USAF B-52, F-100, F-101 and B-66 as well as a model of the U. S. Navy carrier Franklin D. Roosevelt.

There was evidence that nuclear warfare tactics are being studied at the school.

While the Americans were not shown the most modern and important Russian engine and airplane plants, the ones that they did see indicated a high degree of ability to apply mass production processes and techniques.

Soviet Assembly Plant

At a Moscow airplane assembly plant, the USAF experts made these observations, which they say they doubt are typical of the Red's best effort:

- **Work force of 5,000** had a high experience level. There was good production scheduling, and the plant produced good quality products despite a high proportion of handwork. Lack of automation and high-production tooling and presses held down production per man-hour.
- **Assembly jigs are light** and simple. Welded sections are used in such items as landing gears instead of forgings or extrusions used in the U. S.
- **Curved sections** are fabricated from sheet aluminum on simple hand-operated light hammers. Wing and fuselage sections are built up by riveting small parts together.
- **Housekeeping practices** are below U. S. standards.

The airplane plant, Gen. Twining reported, was chosen evidently because it is one of the oldest and not engaged in the manufacture of combat planes. The plant produces Il-14 twin-engine transports, which are now being phased out.

Gen. Twining said he was told the plant will be converted to the manufacture of a Tupolev four-engine, turboprop transport, the Tu-114. (Other Russian sources have indicated that this aircraft is an Ilyushin design [AW July 2, p. 27].)

In an engine-plant tour, the Americans saw Russians producing their version of the British Nene jet used to power some older aircraft such as the Il-28 Beagle bomber, MiG-15 Fagot and MiG-17 Fresco fighters. The factory turned out more than 10,000 units for the MiG-15 during the Korean war.

Gen. Twining reportedly minimized his disagreement with the Administration over additional funds for Fiscal 1957 and the importance of the research and development effort during his appearance before the Senate committee. He did, however, tell the senators that air forces "do not stand still." He added:

"The time and circumstances—and the circumstances include both what we do and what the Soviets do—will undoubtedly bring changes in any given evaluation of the complex question of relative air strength."

In addition to discussing scientific and material observations from his trip to Moscow, Gen. Twining said his party appreciated the opportunity to form an opinion of the professional competence of Soviet air officers.

"Our general impression," he said, "was that the command element in Soviet aviation is made up of tough, aggressive, resourceful leaders." He characterized the leading designers and production men as "enthusiastic, vigorous and confident."

Navy Programs 47 Missile Ships By 1961, Outlines Seaplane Plans

Washington—The modernizing U.S. Navy will place its initial quantity orders for Martin's P6M multi-jet seaplanes sometime during Fiscal 1957 and plans to have 47 missile-equipped ships for the defense of three carrier task groups by 1961.

The Navy's missile and seaplane plans were outlined before the Senate Airpower Investigating Subcommittee by Vice Adm. Thomas S. Combs, deputy chief of naval operations for air, and Rear Adm. John E. Clark, director, Guided Missiles Division of the Office of the Chief of Naval Operations. Their testimony was released last week. The missile schedule, as outlined by Adm. Clark:

- **Eight Tartar-equipped** missile ships in Fiscal 1960 and 17 by Fiscal 1961. The Tartar is manufactured by Convair.
- **Two Convair Terrier** missile ships were programmed for Fiscal 1956. There will be a total of three after Fiscal 1957. The Navy will have four by Fiscal 1959, 13 by Fiscal 1960 and 22 by Fiscal 1961.
- **One Talos** missile ship is planned for Fiscal 1958. There will be three by Fiscal 1959, five by Fiscal 1960 and eight by Fiscal 1961.

Adm. Clark also reported that the Navy's Talos manufactured by McDonnell Aircraft is "a great deal more expensive" than the Army's comparable Nike missile because of the more-exacting requirements for shipboard use.

At present, he said, the Talos unit cost of $200,000 compares with $30,000 for the Nike. This gap will be narrowed, however, as Talos production increases.

In the field of surface-to-surface missiles, the Admiral said the Navy now has in operation four carriers, four cruisers and two submarines equipped with the Chance Vought Regulus I missile.

Within the next year, he said, the Navy will be "reasonably sure of the form that its ballistic missile (the Jupiter project) will take" and already is designing ships to carry it.

Adm. Combs said fleet deliveries of the Martin P6M SeaMaster are scheduled to begin in the fall of 1958. Flight testing of the SeaMaster, he said, has shown that the aircraft has "equal or superior performance" to expectations.

He estimated the cost of the initial production types at $5.6 million. With spares and other equipment, estimated cost of the SeaMaster is $7.9 million, slightly less than the present production cost of $8 million for the Boeing B-52 intercontinental bomber.

The Admiral told the subcommittee that the SeaMaster has a combat ceiling in excess of 40,000 ft. and an unrefueled combat radius of more than 1,500 miles.

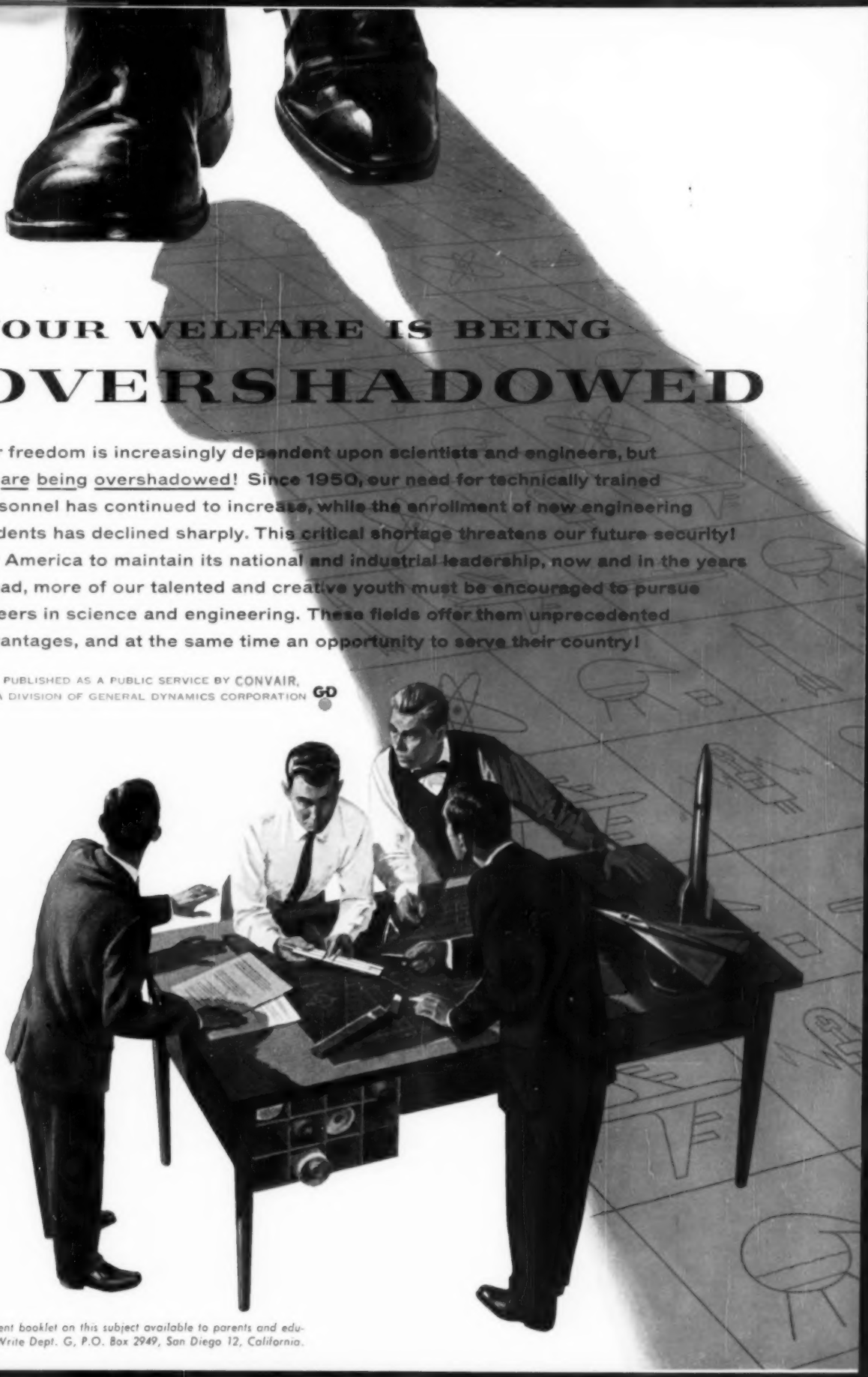
Subcommittee members also pressed the Navy, through Adm. Combs, to move ahead with the development of a seaplane with a performance comparable to that of the B-52.

Adm. Combs told the subcommittee that the Navy has plans for such an aircraft "but we feel that there are a lot of things we have got to learn" before beginning the actual building. He added:

"We are learning a tremendous amount with the SeaMaster (Martin P6M).

"Instead of taking the thing in one big jump we would rather take it in several smaller jumps and be sure of our way as we proceed . . ."

Sen. Henry Jackson (D.-Wash.) said the Navy should be moving aggressively forward, not only with a seaplane B-52 version, but also with an atomic-powered long-range bomber. Both, he said,



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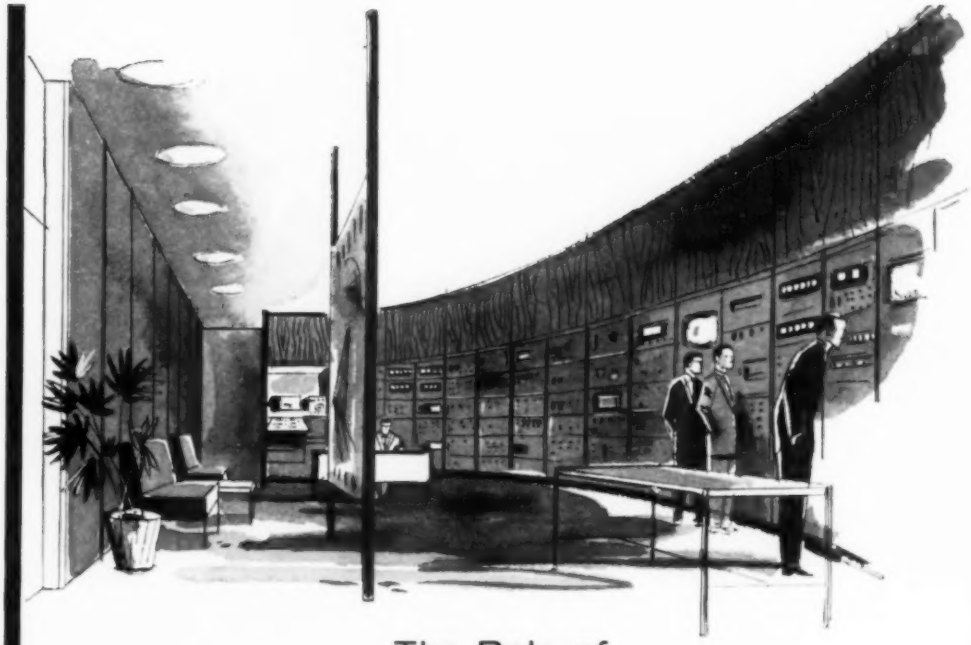
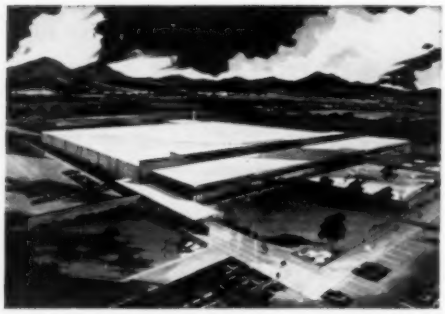
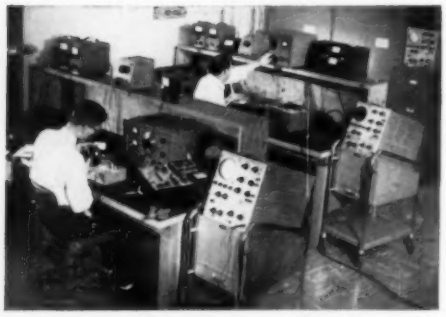


R-W Data Reduction Center now under construction

The Role of INSTRUMENTATION and TEST EQUIPMENT in Systems Work



Denver plant now under construction will augment the Division's manufacturing facilities



Instrumentation development

The complexity of modern weapons systems, as well as certain electronics systems for industrial applications, is such that the design and installation of instrumentation for obtaining experimental test data and converting it into usable forms has become a highly specialized field of technology.

A closely related field is that of test equipment needed for the adjustment and maintenance of the end-product hardware, both in the manufacturing plant and in the field. Experience has shown that the effectiveness of a major new system frequently falls short of its potentialities because of inadequate attention to this essential supporting activity.

In The Ramo-Wooldridge Corporation, the Electronic Instrumentation Division has the mission of bringing to the areas of instrumentation and test equipment a level of competence that is adequate to deal with the often very difficult problems that need to be solved in such work.

Assignments undertaken for a number of government and industrial customers include such diverse projects as flight instrumentation, data reduction equipment, and transistorized power supplies. Another important project of this Division is that of providing The Ramo-Wooldridge Data Reduction Center with a system and arrangement of equipment carefully designed to meet the company's specific requirements. Also in progress is the development and fabrication of field test equipment for an electronic system R-W now has in early production.

A unique and important feature has been incorporated into the services offered by the Electronic Instrumentation Division. For each project, an advisory committee is established composed of experienced systems engineers from other divisions of the company. By periodic reviews, such advisory committees assure that the development work of the Electronic Instrumentation Division takes into account the very special and often not well understood needs which arise in systems work.

Further information about this R-W activity can be obtained by writing to the Director, Electronic Instrumentation Division.

The Ramo-Wooldridge Corporation

5730 ARBOR VITAE STREET • LOS ANGELES 45, CALIFORNIA

Pacific Missile Facility

Washington—The U. S. Navy last week announced that it will use an Air Force facility for a target-drone and guided missile training program in the Pacific. The site will be Bonham AFB, Barking Sands, Kauai, T. H.

Contracts will be let for a $500,000 refurbishing and installation program at the base, which is 110 miles from Pearl Harbor. It will be staffed by five officers and 80 men on rotation from the Naval Air Station at Barber's Point, Oahu.

When in full operation, the facility will fly target drones for Navy exercises at sea, and missiles launched from ships will be recovered at Bonham. The drones will include an improved model of the Chance Vought Regulus.

could be supplied and refueled at locations around the world by atomic-powered submarines.

Sen. Stuart Symington (D.-Mo.), subcommittee chairman, asked Adm. Combs:

"There is no reason why a seaplane. . . . should be limited in load-carrying capacity, range, speed or altitude any more than a land-based plane is there?"

Adm. Combs said there was not.

Later, the Admiral told the subcommittee a long-range seaplane bombing force would have these advantages:

- "**Would be most difficult** for an enemy to locate and destroy" because of its mobility.
- "**Permit the application** of a versatile mining capability and, at the same time, contain the capacity for enlarging the scope of nuclear attack on targets of naval interest."
- "**Augment our carrier striking** forces by adding additional pressure on the peripheral areas of the U. S. S. R."

There would be, Adm. Combs said, all these advantages "with no permanent installations to be constructed, defended, or abandoned on foreign territory."

Huge Atomic Airliner Expected in 20 Years

A civil airliner weighing a million pounds and powered by an atomic engine is a "not unreasonable" expectation within the next 20 years, according to a paper prepared by the International Civil Aviation Organization for delegates to ICAO's Caracas assembly.

Airports of the future must be capable of handling traffic traveling up to 1,000 mph., the paper said, and of accommodating a wide range of landing and takeoff speeds and angles.

Boeing 707 Lands at Los Angeles For BOAC Group Sales Flight

Los Angeles—In a very impressive demonstration, Boeing Airplane Co. last week sent its 707 jet tanker-transport prototype to Los Angeles International Airport for the plane's first landing at a commercial airport. Previously the plane had landed at Bolling Field, Washington, D. C., and at Offutt AFB, Omaha, in its role as a prototype of the KC-135 jet tanker.

The 707, with its interior cleaned up and instrumentation concealed, came to Los Angeles to pick up a 10-man British Overseas Airways Corp. evaluation team which had been at Douglas Aircraft Co. in Santa Monica to discuss possible purchase of jet airliners. The team, headed by A. C. Campbell-Orde, BOAC operations development director, was taken to Seattle for talks with Boeing concerning possible purchase of 16 Boeing 707-320 intercontinental jet airliners, and discussion of delivery dates, a very important factor to the British airline.

With Boeing test pilot A. M. "Tex" Johnston at the controls, the yellow, brown and silver transport gave an indication of its ability when, half way on its base leg to the right runway of a parallel pair at Los Angeles airport, the tower ordered a turn back to the left hand strip. The huge plane, with gear and flaps down and slowed to a base leg speed of about 160 kts., made a sharp, quick S-turn back to the left runway with extreme ease despite its low airspeed.

Landing at a gross weight of 152,000 lb., with the temperature in the high 80s, the plane rolled 4,000 ft. to a complete stop without heavy brake application. Touchdown speed was 113 kts. The plane carried no thrust reversers, but used flaps, spoilers and brakes to slow down.

Taxiing was accomplished easily at about 5% of thrust at 60% rpm. There was no sign of dirt or other debris being sucked into the plane's low-slung four J-57 turbojet engines.

Noise during the pattern, approach, landing and taxiing, was much less than observers had expected, but closeup noise at parking was very loud.

Aboard were Wellwood Beall, Boeing executive vice president, and his family. Although primarily a show flight, the airplane was instrumented for certain exterior pressure studies and cabin noise investigation.

The craft was parked at an American Airlines loading ramp. Visitors and persons waiting to board airliners were shown through the airplane.

Pilots, copilots and flight engineers from the 10 airlines operating out of Los Angeles, many of whom will be flying the 707, swarmed around the plane, plying the crew with questions. Ground crews also went over the aircraft, checking everything they could.

After a short stay at the American ramp, the plane was towed to an out of the way place on the field, but from noon to takeoff at 6 P.M., the plane continued to be a center of attraction for many more visitors who were shown through it.

The flight from Seattle was made in 1 hr. 57 min. for a block-to-block speed of 440 kts. Flight altitude was 35,000 ft. with a headwind of 70 kts. Takeoff weight at Seattle was 179,000 lb. The plane carried enough fuel in its four wing tanks for the round trip. Takeoff from Los Angeles was made after about a 4,000 ft. run. The plane lifted from the runway like a piston-powered transport, rather than with the usual extreme nose high attitude of a swept-wing, heavy-wing-loaded jet plane.

In a press conference during the plane's stay, Johnston and Beall outlined some of the 707's features as a transport:

- **Footprint pressure** very close to that of today's DC-7 and Constellation.
- **Holding pattern** speed of 160 kts. clean, and 140 kts. with 30 degrees of flap.
- **Traffic pattern** speed (noticed by observers when the plane landed) very close to that of current piston-powered transports.
- **Final approach** speed just one knot higher than the DC-6B.
- **Rate of descent** of 14,000 ft. per minute in case of cabin pressure leak or decompression or other emergency.
- **Takeoff roll** of 9,600 ft. on a 100 degree day.

All these characteristics, Johnston said, are for the 707-320 inter-continental model, with a takeoff gross weight of 290,000 lb.

While in Los Angeles, BOAC's Campbell-Orde acknowledged to AVIATION WEEK that his company will announce a decision regarding the purchase of long-range jet transports after his party returns to London.

Campbell-Orde said the "climate" in Britain is better now for an announcement of a purchase of foreign airplanes than it was when BOAC announced some time ago it wanted to buy 10 Douglas DC-7C transports. It had been anticipated then that British turboprops would be available in time to obviate the need for buying foreign piston-powered planes.

Airlines Reach New Growth, Profit Peaks

Healthy year indicated by traffic and revenue records set by the airlines in first half of 1956.

By Craig Lewis

Washington—Traffic and revenue records set by the scheduled airline industry in the first half of 1956 indicate that this will be a year of substantial growth for carriers with profits leading the way.

Capacity shortages are a factor in keeping the industry's growth below the phenomenal rates of the 1955 boom, but the resulting improvement in load factors indicates that profits will outgain revenues and traffic.

The nation's trunk airlines operated 10.5 billion passenger-miles in the first six months of 1956, moving about 13% ahead of last year's traffic. Revenues reached the $615 million level.

Gains made by the international carriers indicate they are on their way to a 20% growth this year. Local-service airlines are continuing their pattern of steady, substantial growth with a 29% gain in traffic during the first half.

Profit Prospects Bright

Although the industry won't grow quite so fast in 1956 as it did in the extraordinary 1955 traffic boom, this will be a more normal, more stable growth year for the airlines. And, while the carriers' traffic won't grow so fast, their profits will.

The second half of the year always produces more traffic than the first half, and profit prospects look bright when the important summer traffic starts filling the long haul services of the trunklines. Since capacity will not experience any appreciable increase this summer, load factors should improve their position.

Results in the first half suffered slightly from a first quarter that was disappointing to many airlines operating in the Northeast—Capital, American, Northeast, Colonial, Mohawk, Allegheny. They were hampered by the worst weather in years. Western Air Lines was grounded 73 days by a strike.

To a large extent, airline prosperity relies on the general prosperity of the nation's economy for its impetus. Forecasts for the rest of the year predict a leveling off of business activity in the third quarter and an upturn in the fourth quarter. Predictions of an adjustment or slight recession in the third quarter have disappeared, and economists have developed a more optimistic outlook on the rest of the year.

Along with general economic prosperity, the airlines view the expanded capital spending plans of U. S. industry as a favorable factor in traffic development. The McGraw-Hill Economics Department says that industry plans to spend $39 billion for new plants and equipment this year. To the airlines, this means increased numbers of salesmen, engineers and technicians traveling around the country.

Approval by Congress of a new $33 billion highway program is another development which means more business for the airlines. This tremendous expansion of the highway system will mean more air travel by construction executives and engineers who are working on the program. Most of this business traffic travels on first-class flights.

The Big Four—American, Eastern, United and TWA—made greater traffic gains in the first half than the smaller trunk airlines. Passenger-miles for the Big Four increased 14% while the smaller carrier's traffic increased 8%.

First-class traffic is continuing to maintain a steady growth, but coach traffic has lost some of the dynamic aspects of its earlier boom. Coach traffic isn't growing as fast, but it still continues to expand its share of the market and is now approaching 40% of total traffic.

Coach Expansions

The most significant factor in coach operations in the first half of 1956 was the expansion of services by American and United. American, which introduced the first DC-7 coach in May, offered 158.2 million seat-miles in coach service last May as compared with 141.8 million in May of 1955. The carrier sold 112 million coach passenger-miles in May, 1956, and 90.5 million in the previous May.

United operated 191.1 million coach seat-miles in May and sold 123.6 million passenger-miles as compared with 141.4 million seat-miles and 96.3 million passenger-miles in May, 1955.

Eastern and TWA, which have long been promoters of coach service, also registered gains in coach traffic. Among the smaller trunklines, carriers that acquired new long-haul routes in recent route cases increased their coach business substantially. Delta, for example, increased coach seat-miles from 33.7 million in May, 1955, to 54.7 million in May, 1956, and increased coach passenger-miles from 24.2 million to 32.5 million in the same period.

The profit picture for the trunk airlines has improved in the first half in spite of the pressures of a slight upward trend in expenses. Expenses have moved generally downward in the past few years, but they began a slight rise in the first quarter and increased 13% while revenues were increasing 11.5%.

The key to improved profits lies in the increase in load factors (see box p. 39). As load factors moved upward

Domestic Trunk Airline Traffic January-May 1956 and 1955

	Revenue Passenger-Miles (000) Jan.-May 1956	Jan.-May 1955
American Airlines	1,813,356	1,610,174
Eastern Air Lines	1,692,119	1,496,096
Trans World Airlines	1,183,119	1,005,301
United Air Lines	1,594,800	1,406,977
Subtotal	6,283,394	5,518,548
Braniff Airways	286,719	245,305
Capital Airlines	351,621	297,079
Colonial Airlines	39,075	59,677
Continental Air Lines	99,994	92,858
Delta Air Lines	470,465	422,670
National Airlines	483,645	425,295
Northeast Airlines	38,268	35,464
Northwest Airlines	316,456	280,438
Western Air Lines	102,159	191,269
Subtotal	2,188,402	2,030,055
GRAND TOTAL	8,471,796	7,548,603

Domestic Trunk Airlines Passenger Load Factors

	1956	1955
January	63.2	61.7
February	62.1	60.6
March	65.5	62.2
April	65.8	66.4
May	63.3	63.5

through the sixties, the gap between revenues and expenses widens, and profits increase accordingly.

A general shortage of capacity has developed this year and has been the main factor in boosting load factors. The trunklines are in one of their periodic cycles where traffic growth moves ahead of increases in capacity.

The last big increase in capacity occurred two years ago when the airlines started putting the DC-7 and the Super-G Constellation into service. Since then, the carriers have been busy building traffic to fill the new capacity. Now the traffic growth curve has passed capacity growth, and load factors will be high until another heavy round of transport deliveries takes place next year.

Re-Equipment Problems

The present capacity squeeze illustrates the re-equipment problems of the airlines. Since transport aircraft have a 16-month to three-year lag between order and delivery, the carriers are unable to provide new service as the traffic develops. They also must order more transports than traffic warrants at the time to keep costs down.

As a result of this approach to providing new capacity, the airlines are not getting much new equipment now, but they will move into a cycle of heavier deliveries in September. Braniff Airways, American Airlines and Western Air Lines will get new aircraft in the fall, and Capital will receive 19 more Viscounts by the end of the year.

The airlines will receive large numbers of aircraft next year and until mid-1958, when present orders for piston transports end. Another round of orders for piston transports may extend the deadline past mid-1958 if the airlines decide delivery schedules for turbine transport are more optimistic than realistic. The carriers may have to order more piston-type capacity to handle traffic in the 1959-60 period if the jets don't meet their delivery schedules.

Il-12 airliner parked at Vnukovo. Il-14s, more powerful development of Il-12 with square, not rounded tail, are in background.

Aeroflot Operation Geared to Growth

By Robert Hotz

Moscow—Vnukovo Airport, about 20 miles south of here, is the hub of Aeroflot's domestic and international operations and a good place to observe the current Soviet airline routine.

During four visits to Vnukovo in eight days, we always found the parking area crowded with transports. At least 100 Il-12 and Il-14 types were on the field plus three Tu-104 twin-jet transports, three Il-20 twin-jet mail and cargo planes, at least 50 DC-3 types know as the Li-2 and a Badger twin-jet bomber used to introduce Aeroflot crews to turbojet operations.

Ilyushin transports with Czech, Chinese, Polish and East German markings also were on the tarmac at Vnukovo.

These planes all were in the active area. Soviet officials said most of them represented either arrivals or departures scheduled during a 24-hour period. In addition, there were at least another 20 Il-14 transports in the Aeroflot maintenance area undergoing various types of overhaul, including rudder repairs and engine changes.

The Vnukovo terminal building is small by western standards but handles a steady stream of passengers, mail and cargo on a round-the-clock basis. There are only four arrival and departure ramp positions, but they are seldom empty. Traffic flow appears just as heavy at 4 A. M. as it does at 4 P. M.

Luggage Passed Unopened

There is an air of casual informality about departures. A public address system announces arrivals and departures, but there is no gate check of passengers as they stream onto the ramp and board their planes. Nor are boarding passes used. At Copenhagen's Kastrup Airport, a boarding pass was issued for the Aeroflot flight to Moscow. But at the border station of Riga, the passport and customs check was perfunctory with luggage passed unopened.

Only a declaration of foreign currency was required. It is illegal to import Russian rubles, but foreigners are supposed to declare their foreign currency on entry if they wish to take it out with them on exit. Actually, border guards at Riga didn't bother to check these currency declarations on exit.

Aeroflot is trying hard to make a good impression on its foreign passengers. It has multi-lingual personnel at Riga to assist passengers through the border routine. A stewardess has been added for flights to Scandinavia, the crew issues a flight progress report in Russian and English, a snack of tea and cookies is served and lozenges are distributed by the stewardess before take-off and landing. Seat belts have been installed, but they appear to be mostly for the morale of foreign passengers.

Pilots allowed passengers to inspect

PRESENCE of Red delegates Miss Zoya Nikiforova, Oleg Sapounov and Eugene Fedine at ICAO assembly in Caracas shows increasing Russian interest in international air transport.

the Il-12 cockpit and explained their instrument panel and flight operations, with the plane's stewardess acting as interpreter.

Aeroflot also is studying western standard of cabin service closely against the day when it will have to serve in-flight meals and provide such service on its competitive international Tu-104 flights.

Vnukovo Airport

Physically, the airport at Vnukovo has good facilities including concrete runways long enough to handle the Badger and Tu-104 easily, a beam-type instrument landing system, GCA radar approach control and two types of high-intensity approach lights. One approach lighting system appeared to be of the condenser flashing type with a double row of bar lights.

The other lighting system appeared to be a double row of ordinary high intensity lights in a pattern funneling toward the threshold of the runway.

The runway threshold is marked by a pair of fixed searchlights at each side of the end of the runway.

Aeroflot uses neither battery carts nor fire extinguishers during starting operations.

The engines are started from the aircraft battery. However, both a battery cart and fire guards are provided for Finnair and Scandanavian Airlines System for their Convair and Scandia operations.

Contrary to current rumors, Aeroflot pilots run-up their engines and check their magnetoes before takeoff, although they don't waste any time on this operation.

Both the Il-12 and Il-14 are equipped for instrument flying with a bank-and-turn indicator, an artificial horizon, radio compass, and cockpit cross pointer indicator for the beam landing system.

During the course of the flight from Copenhagen to Riga and Moscow, our Aeroflot pilots flew on instruments for two-and-three-hour stretches at an altitude of 8,000 ft.

Il-14 Limitations

Operations of the unpressurized and unsupercharged Il-12 and Il-14 types are limited by weather and terrain. For example, the twice-weekly flight to Kabul is often delayed by weather at Tashkent for several days because the Aeroflot equipment cannot top the mountains surrounding the Afghanistan plateau and must wait for clear weather to fly up the passes. Also the violent summer thunderstorms around Moscow can't be topped by these unpressurized transports and operations wait until the storms dissipate.

The Il-12 is a twin-engine, tricycle gear transport that has a fuselage and wing similar to a DC-3. There are two versions of the Il-12 now in service with Aeroflot, one of them is easily distinguished externally by the addition of a dorsal fin to the vertical tail.

Normally, the Il-12 carries 18 passengers, but for international runs it has 21 seats to approximate the Scandia's 24.

The aircraft's adjustable seats are comfortable, but the noise and vibration level in the cabin is extremely high. Heavy tail shudders occur when the pilots have difficulty in synchronizing the engines.

The Il-12 cruises at about 200 mph., and has four-bladed propellers.

Two Il-14 Versions

The Il-14, which is still in production for both Aeroflot and the Soviet air force, comes in two versions. One is an 18-passenger VIP transport used to transport top government officials and foreign guests. The other is a 24-passenger airline version. It cruises at about 230 mph., has three engine exhaust stacks extending to the trailing edge of the wing as in early Convair-Liners, nose mounted landing lights, an enlarged squared vertical fin and external, plastic-enclosed antennas running the length of the fuselage.

Both the Il-12 and Il-14 have large flap areas making it possible for them to operate out of relatively-small, unimproved fields.

Aeroflot also operates a large fleet of 15-passenger Li-2 types, the DC-3 types produced in quantity under a World War II license.

For feeder operation, the Antonov 12-passenger, single-engine Colt is used with wheels, skis and floats, and a small five-passenger bi-plane extends Aeroflot feeder operation into the Soviet hinterland.

Aeroflot Crew Training

Aeroflot trains its own pilots, flight engineers, radio operators, navigators and airport operations and maintenance personnel. Flight crew trainees are picked from high school graduates and trained in special Aeroflot schools, which operate separately from the military flight training program. Flight crews are paid by the kilometer flown, thus insuring an automatic pay raise when Aeroflot's new and faster jet transports become operational. On international runs, flight crews are assembled eight hours in advance and eat a meal or take a final nap in Aeroflot quarters. International schedules are arranged so that a Soviet crew never remains overnight in Copenhagen, Helsinki or Stockholm.

Aeroflot also operates commissaries for its personnel where food and other supplies can be bought at cut-rate prices.

(This is the second of two first-hand reports on the operations and facilities of Aeroflot, Russia's state-owned airline.)

DC-6B Meets Tu-104

Moscow—Soviet officials reacted slowly to the arrival of foreign transports at Moscow's Vnukovo terminal during the Tushino air show week. Russian civilians at Vnukovo saw the highly polished DC-6B that brought USAF Gen. Nathan E. Twining to Moscow, the four-jet Comet II that brought the Royal Air Force delegation and the twin-engine Bretagne flown by the French parked on the ramp at Vnukovo.

After a few days, during which the foreign aircraft attracted considerable attention, the Soviets towed a Tu-104 twin-jet transport with Aeroflot insignia into the line of foreign aircraft and placed it closest to the passenger terminal area so that its perspective to onlookers was much better than that of the foreign transports.

RAMP at Newark Airport at night has in background three-year-old passenger terminal, already short of ticket counter space. The airport, regaining its place in the New York metropolitan area, handled almost 2 million passengers in 1955.

Newark Wins Back Airline Business

By Glenn Garrison

New York—Newark Airport, despite unusual handicaps which have slowed its development, is steadily increasing its share of the richest air travel market in the world.

Airlines using the New Jersey field are confident that its importance in the New York metropolitan area airport complex will continue to grow, and most are backing their confidence with schedules, promotion and plans.

Before Newark was closed in 1952 following a coincidental series of fatal crashes, it handled 20% of the region's domestic passengers (1951). Last year, with almost 2 million passengers, Newark had climbed back to 19% of the regional total. This year, on the basis of first five month figures, it probably will at least reach the 1951 share again.

Higher Ranking

Last year Newark inched up from 13th to 11th in national airport rankings by total air carrier operations. LaGuardia and New York International remained at 2nd and 7th.

The airlines have been faced with a peculiar selling problem in boosting their Newark business. About half the airport's traffic is bound to or from New York, across the state line and the Hudson River from Newark. This New York business is vital to successful operation, and there must be more of it if the airport is to grow. But people often fail to realize Newark is a New York facility.

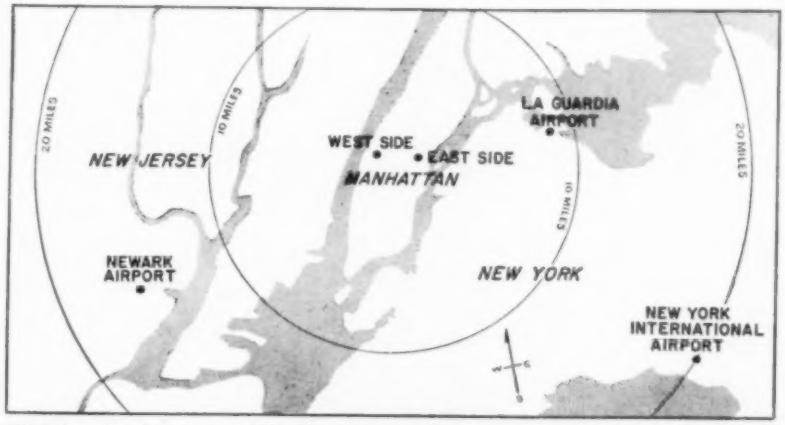
Actually, by virtue of the New Jersey Turnpike and Lincoln Tunnel, Newark is handier for many New York travelers than either of the other airports. Ground times to Manhattan are listed as 21 minutes from Newark, 28 minutes from LaGuardia, and 35 minutes from Idlewild (none of which hold up during the rush-hour traffic scramble in Manhattan).

To overcome this psychological block, the airlines and the Port of New York Authority, operator of all three of the airports, have devoted considerable effort to selling Newark as a New York terminal. Airline sales people downline from the area have been extensively briefed, in many cases brought into Newark for on-the-spot orientation. Advertisements in down-line cities have plugged Newark for the New York traveler. Some 150,000 copies of a brochure stressing the point have been produced by the Port Authority and distributed by the airlines.

West Side Terminal

Newark traffic received a strong stimulus with the opening last September of the West Side Airlines Terminal in Manhattan. This facility, jointly owned by the airlines, serves Newark exclusively. Coach service to the airport, formerly routed from the East Side Airlines Terminal which serves the New York airports, involved a struggle through clogged cross-town traffic which added 20 minutes to the running time.

Business from the West Side terminal has been so good that expansion



THREE major airports serve New York metropolitan area. Newark airport, in terms of driving time, is closer to Manhattan than either LaGuardia or Idlewild.

FASTER
FARTHER
HIGHER

The development of guided missiles of every type is becoming one of the most competitive areas in our world today . . . for supremacy in this field can well determine peace for many years. The race is now for greater speed, higher altitude, longer range, more sensitive control.

The strength of Western defense lies to a great extent in the development for the Armed Forces of these new weapons systems suited to the supersonic age. The once deadly cannon, machine gun and rocket are being superseded by complex weapons of great ingenuity.

Canadair has long had a prominent role in Canada's guided missile program, applying the knowledge acquired in years of experience in advanced aircraft systems engineering . . . and Canadair's research, engineering and manufacturing resources are constantly making further important contributions to projects in this field.

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CANADAIR HAS PRODUCED MORE JET AIRCRAFT THAN ANY OTHER CANADIAN MANUFACTURER

may be necessary in a couple of years. In June, about 84,000 passengers used the facility on their way to or from Newark.

The terminal, incidentally, houses Trans World Airlines' reservations center for the area, and American Airlines is moving its regional reservations from LaGuardia to the terminal sometime this month. Delta Air Lines, Braniff Airways, Allegheny Airlines, and Mohawk Airlines also handle their Newark reservations from the facility.

Public Opinion

When Newark Airport reopened after the 1952 closing, the airlines faced a climate of public opinion not conducive to unlimited confidence in the future of the field. Some of them have been understandably cautious in building Newark schedules, with business booming at the New York airports.

The community relations problem at Newark seems to be under control. A suit brought in 1954 against the airport as a public nuisance, and seeking to enjoin operations, is quiescent. Plaintiffs in the suit are the Mayors' Committee, Inc. (Mayors of Newark, Linden, Hillside and Union), and six individuals. Original defendants were seven airlines, the Port Authority, the Civil Aeronautics Administration, and the United States of America, but all except the airlines have been legally eliminated.

The airport's most vociferous critic, Meyer C. Ellenstein—former city official in charge of the airport, former mayor of Newark, present chairman of the Mayors' Committee—clashed with N. J. Governor Robert Meyner during airport hearings last year and almost was ejected from the hearing room.

Two new carriers Braniff and Delta, came into Newark last February as a result of the Southwest-Northeast Service Case decision of the Civil Aeronautics Board. Both are happy, although lack of space at LaGuardia and Idlewild eliminated any question of choice of airport.

Texas Geography

Braniff, now operating three daily schedules at Newark, is making strenuous efforts to convince Texans that New Jersey, in this case, is synonymous with New York. With delivery of DC-7C equipment by October, the airline plans to split its operation between Newark and Idlewild, adding a fourth flight to the area so that two will be operated at each airport. Thus Braniff hopes to get a foot in the door at Idlewild, but at the same time keep its Newark service and eventually expand it as the selling problem is licked.

Delta, like Braniff, has experienced a good load factor on its long-haul flights through Newark, a less satisfactory load factor on the short-haul legs, as Newark to Philadelphia and Baltimore. Delta started at Newark with three daily flights, now schedules seven. The airline's business has split about equally between New Jersey and New York points.

If Delta is awarded the New York-Florida route, it will serve both Newark and Idlewild on the run. Delta, too, is anxious to get into Idlewild when facilities are available so as to increase the scope of its area business. But the airline expects continuing expansion at Newark as well.

Of the carriers serving Newark in addition to one or both New York airports, Eastern concentrates most heavily on the New Jersey field. The carrier's faith in Newark has been enduring, and as far as Eastern is concerned, the sales job there has been accomplished. Claiming to handle 40% of the airport's traffic, Eastern operates an average of 35 daily flights at Newark, compared with about 30 at each of the other fields.

United, with 18 flights at Newark, 16 at LaGuardia and 12 at Idlewild, feels that Newark's future is assured. The airline plans to occupy a new $3 million hangar at Newark, under construction by the Port Authority. The hangar is the first to be built at Newark since World War II.

Favors LaGuardia

American, entrenched at LaGuardia with a fabulous 119 daily flights, is moving slowly at Newark, with 20 schedules now operating daily there (and 29 at Idlewild). American doesn't feel the market at Newark as yet warrants large-scale increases. But the airline foresees a prosperous future for the New Jersey field and will step up service within a year or so.

Trans World Airlines has added to its schedules at Newark, now offers 11 daily, most of them in Martin 404 equipment. TWA operates 34 daily domestic flights out of Idlewild, 13 at LaGuardia.

National Airlines, which returned to Newark in December, 1953, operates seven daily flights, including a Miami daycoach, at the airport. National's Idlewild flights total 22 daily. The airline plans future expansion of Newark schedules, expects the airport's importance to increase. As far as National is concerned, selling Newark as a New York terminal hasn't proved to be a major problem.

Capital Airlines moved to LaGuardia after the closing of Newark and didn't come back until December 1955. Pleasantly surprised by the success of its Newark operation, the airline now offers 17 daily departures there, 25 at LaGuardia. Capital, like the other carriers, wants to exploit the regional nature of the New York area traffic by going into Idlewild, too. But Capital plans to stay in Newark with at least 25 or 30 daily flights even after facilities are available at Idlewild. It is now negotiating with the Port Authority for early construction of a hangar at Newark.

Two local service carriers, Allegheny and Mohawk, serve the New York City area through Newark. Both were there before the field closed and returned when it reopened.

The airport is also served by New York Airways helicopters, and Flying Tiger Lines and Slick Airways in the all-cargo field.

Lowen Defends CAA Airways, Airport Plans

Washington—Terming the U. S. air navigation system the world's finest, Charles Lowen, Civil Aeronautics Administrator, told a congressional group last week that "we will be ready to meet the problems of the jet aircraft when it is ready for civil operations."

Testifying before the House Government Operations Subcommittee with four other CAA officials, Lowen strongly defended CAA's progress in airways and airport development. He called the five-year airways improvement plan the "greatest airway program in history," but agreed with Subcommittee Chairman Robert Mollohan (D.-W. Va.) that the plan could be "telescoped" into three years.

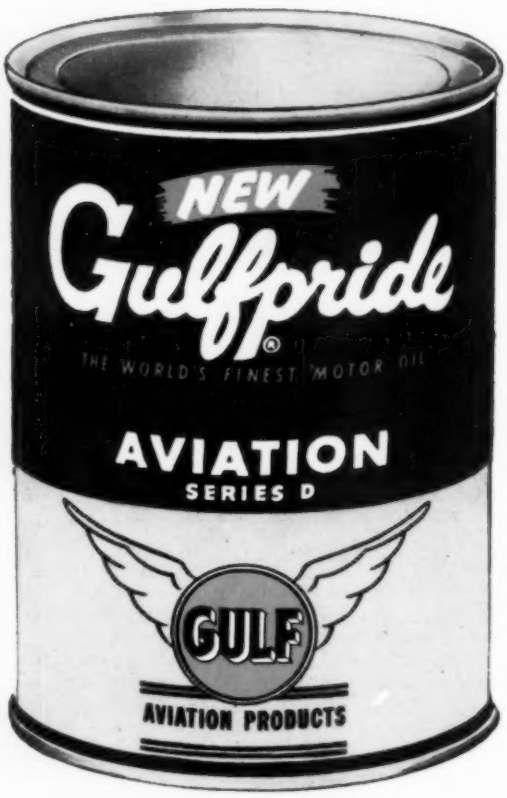
Lowen also said the area of activity of the Technical Development Center should be "broadened."

The center, he said, should be strengthened in terms of money, facilities and staffing.

Lowen described the Air Coordinating Committee as a "necessary evil," adding, "we need its support." He said the committee is "just one of those things we must live with" and "if we did not call it ACC, it would still be with us under another name."

The Civil Aeronautics administrator charged that "too many problems are relegated to committee decision" in matters of air-traffic control. He said that if the CAA administrator cannot resolve any differences after hearing both civil and military requirements, "he should be fired."

Lowen also reported that CAA has been negotiating with Boeing Aircraft "for some time" to obtain a 707 jet transport for use in indoctrinating its personnel in jet operations. This week the CAA will begin training flight and maintenance crews for the one B-57 and two B-47 Jet bombers it will receive from the Air Force. The three aircraft are scheduled to be placed in operation within 90 days.



Now... a detergent oil specifically developed for all types of aircraft engines!

New Gulfpride Aviation Series D combines Gulf's exclusive Alchlor Refining with a remarkable new detergent additive. Together, they give you a new aviation oil that keeps all types of aircraft engines cleaner than non-detergent oils . . . *without* developing any undesirable side effects!

Cleaner engines

New Gulfpride Aviation Series D greatly reduces carbon, coke and varnish collection around rings and valve stems. Cuts down on power-robbing sludge . . . eliminates harmful deposits in the combustion chambers.

More hours between overhauls

The high film strength of New Gulfpride Aviation Series D substantially reduces wear on parts. Why not try it for yourself? See how it lowers operating and maintenance costs; provides safer engine performance.

New Gulfpride Aviation Series "D"

GULF
AVIATION PRODUCTS

Airline Traffic — May 1956

	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American	688,794	403,459	**68.43**	1,706,029	799,098	5,387,357	**46,456,328**	**58.60**
Braniff	154,642	60,886	**60.54**	234,997	132,642	389,985	**6,593,390**	**54.15**
Capital	252,830	86,049	**59.86**	260,556	180,476	281,217	**8,953,605**	**45.00**
Colonial	36,103	8,637	**46.25**	13,668	7,377	31,764	**855,031**	**45.61**
Continental	59,259	21,060	**50.59**	74,469	27,897	120,334	**2,243,465**	**46.10**
Delta	201,646	92,599	**60.72**	342,038	248,854	606,210	**10,102,254**	**55.79**
Eastern	606,772	292,560	**59.91**	924,416	398,333	1,030,894	**32,028,202**	**46.83**
National	103,073	68,068	**70.68**	246,922	46,246	399,959	**7,647,230**	**68.78**
Northeast	48,709	9,707	**58.20**	12,043	15,773	32,891	**938,163**	**56.25**
Northwest	112,173	72,185	**54.69**	403,672	206,565	603,971	**8,288,444**	**47.74**
Trans World	353,703	267,399	**63.35**	1,024,927	635,310	1,803,667	**29,065,386**	**59.32**
United	529,790	361,263	**64.02**	2,282,814	968,937	3,943,136	**41,945,558**	**56.26**
Western	88,299	41,511	**60.35**	215,852	79,442	184,657	**4,447,140**	**55.84**
INTERNATIONAL								
American	9,893	6,300	**57.19**	10,728	453	293,101	**950,853**	**62.08**
Braniff	2,644	5,763	**48.49**	14,033	.....	81,802	**746,119**	**52.48**
Caribbean Atlantic	12,415	926	**52.35**	1,188	.....	2,061	**86,680**	**49.28**
Colonial	5,161	4,002	**86.25**	177	.....	3,153	**434,766**	**66.05**
Delta	4,404	5,285	**58.31**	6,538	.....	43,324	**596,112**	**46.94**
Eastern	15,941	22,477	**55.90**	68,610	.....	71,545	**2,523,402**	**50.10**
National	7,989	4,544	**48.66**	8,314	3,920	29,252	**506,850**	**45.09**
Northwest	11,101	19,435	**55.93**	919,516	16,175	815,370	**3,905,922**	**66.09**
Pan American								
Alaska	7,234	8,683	**67.19**	44,097	.....	419,868	**1,373,065**	**57.41**
Atlantic	92,424	108,286	**66.19**	965,682	.....	1,922,829	**14,047,394**	**64.08**
Pacific	22,677	69,671	**70.68**	1,132,600	.....	1,350,465	**9,961,585**	**68.19**
Latin America	88,189	82,617	**57.24**	373,259	.....	3,099,033	**11,441,679**	**55.58**
Panagra	11,838	13,581	**56.53**	51,813	.....	361,550	**1,877,300**	**57.56**
Trans World	26,918	64,991	**61.72**	823,123	.....	748,068	**8,440,576**	**73.80**
United	7,393	18,366	**64.33**	127,363	.....	68,490	**2,091,145**	**60.13**
LOCAL SERVICE								
Allegheny	36,530	6,016	**44.85**	7,164	18,177	4,552	**603,725**	**45.57**
Bonanza	11,535	2,455	**42.54**	3,942	2,262	5,934	**244,002**	**40.77**
Central	11,663	1,853	**36.99**	3,957	2,041	6,339	**189,543**	**33.11**
Frontier	16,266	4,258	**46.08**	17,117	7,664	67,020	**498,437**	**56.62**
Lake Central	12,889	1,956	**39.98**	2,088	10,690	.....	**189,736**	**37.77**
Mohawk	33,483	5,984	**56.11**	6,431	8,745	11,067	**596,951**	**55.97**
North Central	46,870	7,102	**50.01**	19,630	26,966	.....	**724,633**	**44.74**
Ozark	27,860	4,278	**38.37**	10,500	15,396	6,316	**429,711**	**39.09**
Piedmont	36,262	6,839	**56.17**	14,437	12,675	12,971	**694,953**	**56.05**
Southern	16,399	2,902	**45.92**	9,289	12,863	.....	**299,854**	**43.84**
Southwest	24,147	4,608	**44.52**	8,702	4,695	8,698	**460,795**	**43.38**
Trans Texas	18,479	4,170	**40.34**	12,364	9,526	19,037	**438,789**	**37.14**
West Coast	19,812	3,409	**47.55**	3,715	2,080	5,766	**319,116**	**50.39**
HAWAIIAN								
Hawaiian	33,734	5,059	**64.58**	5,367	.....	113,932	**571,327**	**57.24**
Trans Pacific	14,164	1,795	**47.96**	857	.....	8,839	**151,598**	**49.19**
CARGO LINES								
Aerovias Sud Americana*	.....	.....	.....	.....	.....	.....	.....	.....
Flying Tiger	4,703	17,245	**98.53**	24,827	.....	5,410,163	**7,159,557**	**72.31**
Slick	4,750	24,367	**98.55**	70,355	.....	4,411,536	**6,918,678**	**76.98**
Riddle*	.....	.....	.....	.....	.....	.....	.....	.....
HELICOPTER								
New York Airways	3,765	71	**61.21**	1,065	1,343	655	**9,637**	**63.64**
Los Angeles Airways*	.....	.....	.....	.....	.....	.....	.....	.....
Helicopter Air Service	.....	.....	.....	2,694	.....	.....	**2,694**	**44.17**
ALASKA								
Alaska Airlines	4,393	1,612	**27.29**	43,327	.....	516,689	**743,700**	**45.38**
Alaska Coastal	4,421	415	**65.62**	4,551	.....	4,082	**50,864**	**67.25**
Byers Airways	234	24	**34.28**	670	.....	827	**4,178**	**78.93**
Cordova	1,461	333	**59.57**	2,783	.....	125,637	**162,683**	**53.43**
Ellis Air Lines	5,157	291	**52.71**	2,077	.....	3,216	**34,957**	**62.77**
Northern Consolidated	1,290	466	**41.06**	19,724	367	215,264	**286,940**	**74.83**
Pacific Northern	11,422	8,996	**36.61**	78,880	.....	312,158	**1,359,899**	**68.31**
Reeve Aleutian	796	378	**51.85**	13,312	.....	33,540	**88,163**	**59.20**
Wien Alaska	2,387	1,073	**18.94**	29,694	.....	1,141,926	**1,280,679**	**95.49**

*Not available.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

New G-E Turbostarters give fast starts without ground power assistance

Sixty-pound unit produces more than enough horsepower to bring the engines of a USAF medium bomber to idle speed within 25 seconds—anywhere.

G.E.'s cartridge turbostarter makes the Martin B-57 one of the first USAF jet aircraft in production to be equipped with ***self-contained*** starting power. With this lightweight system, the planes can operate from the most advanced bases, even where ground support may not be readily available. At any base, instantaneous group take-offs are now possible without waiting for ground power—allowing the planes to be dispersed for maximum protection against air attack.

Speed and Reliability

According to E. G. Uhl, Martin's Vice President of Engineering, "The Martin Company has used General Electric cartridge starters since they were available. Thousands of starts have been accomplished successfully under all types of environmental conditions. This starter gives our Air Force the most rapid engine start available and frees ground crews from the burden of handling expensive, complex starting equipment."

Application to Any Aircraft

General Electric self-contained starters are designed to meet the needs of tomorrow's jet aircraft starting power, either military or commercial. In addition to the models now available, a 46-lb fuel/air turbostarter that is only 12½ inches long and will produce 10 ft-lb of torque for each pound of weight is in the works. This drive can be easily modified for your specific engine requirements and energy sources.

For further information on G-E turbostarters and other accessory drives, manufactured at the Aircraft Accessory Turbine Dept., West Lynn 3, Mass., contact your local G-E Apparatus Sales Office.

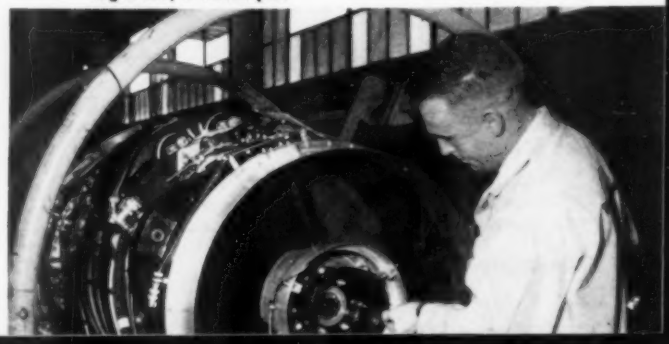
231-3

Progress Is Our Most Important Product

GENERAL ELECTRIC

Only two airframe connections, electricity and exhaust, are required to mount the starter.

Integral quick attach-detach mechanism makes mounting a fast, one-man job.



CAB ORDERS

(June 28-July 4)

GRANTED:

Okanagan Helicopters Ltd. authority to use any one of 22 Canadian-registered Bell helicopters Model 47D-1 or 47G to conduct pipe line patrol flights between Sumas, British Columbia, Anacortes, Wash., and Ferndale, Wash., for Trans Mountain Oil Pipe Line Co. The authority terminates Mar. 31, 1957.

Riddle Airlines an exemption to lease and purchase one C-46 aircraft from Palm Aircraft Sales.

Continental Air Lines an exemption to continue unrestricted service between Austin and Houston, Texas, until July 22, 1957.

Flying Tiger Line an exemption to perform four charter flights to New York from Hamburg, Munich and Athens for the Intergovernmental Committee on European Migration.

Northern Consolidated Airlines and Wien Alaska Airlines an extension of their agreement with Westair Transport for lease of C-46 aircraft until Aug. 31, 1956.

Slick Airways an exemption to perform a charter flight from Baltimore to London carrying a ship's crew for Esso Corp. under an agreement with British Overseas Airways Corp.

Trans World Airlines an exemption to provide free transportation to certain employes of Pratt & Whitney and Wright Aeronautical for in-flight observation of engine performance.

Aerovias Sud Americana, Pan American World Airways and Pan American-Grace Airways permission to intervene in the Transportes Aereos Nacionales permit renewal case.

Flying Tiger Line an exemption to perform transatlantic charter flights for the National Lutheran Council, the Pratt & Whitney Aircraft Club of Southington, the United Singers of St. Louis, the Hamilton Standard Travel Club and the Gaelic Athletic Assn.

APPROVED:

Agreements involving Northwest Airlines, North Central Airlines and various other carriers relating to intercarrier arrangements.

ORDERED:

Arthur E. A. Mueller to cease and desist from dealing in securities of an air carrier involved in a rate conference in which he is a participant, to cease and desist from so dealing if, within six months before the opening of a mail rate conference, he has resigned from a position with the air carrier involved and ordered to file a required compliance report in connection with any future mail rate proceeding in which he is a participant.

Trans Caribbean Airways' authority to operate three charter flights for the Intergovernmental Committee on European Migration amended to change the origination point of one flight from Hamburg to Munich and to add one flight from Hamburg to New York.

DISMISSED:

Portions of applications filed by Delta Air Lines and Trans World Airlines in the Great Lakes-Southeast Case at the request of the carriers.

DENIED:

Airline Transport Carriers' application for exemption authority to operate between San Francisco, Oakland, Los Angeles, Burbank, San Diego and Tijuana, Baja California, Mexico.

Eastern Air Lines' request that all proposals involving non-stop service between Chicago and Charlotte be severed from the Great Lakes-Southeast Case and set down for separate hearing.

Northwest Airlines and Pan American World Airways' applications for exemption authority to conduct military charter operations during July, August and September, 1956.

Shortlines

► **Air France** carried 412,659 passengers during the first quarter of the year, a 29% increase over 1955 first-quarter traffic. Passenger-miles increased 23% in the same period, and the first-quarter load factor was 71%.

► **Air Transport Assn.** reports the scheduled airlines operated with a passenger fatality rate of .59 per 100-million passenger-miles during the year ending in May. The rates were .71 for the domestic airlines and .10 for the international and territorial carriers.

► **Delta Air Lines** has given Lockheed Aircraft Service-International a three year contract for maintenance and overhaul of the four Constellations the airline purchased from Pan American World Airways earlier this year. Work will be done at the LASI base at New York International Airport.

► **Israel** plans to establish air service to Venezuela and other South American points within a year.

► **Linee Aeree Italiane** has added a new service between Milan and Belgrade with two tourist flights a week.

► **Mohawk Airlines** boarded 34,562 passengers in June, 45.7% above the June, 1955 figure. The carrier boarded 165,443 passengers during the first half of 1956, an increase of 37.4% over the same period last year.

► **North Central Airlines** carried 55,635 passengers on its system last month, an increase of 26% over June, 1955. North Central claims it is the first local airline to carry more than 50,000 passengers in any one month.

► **Pan American World Airways** has been named the official carrier of U. S. athletes traveling to the Olympic games at Melbourne. Pan American will fly more than 350 American athletes, trainers and Olympic officials to the games next November.

► **Piedmont Airlines** carried 40,379 passengers in June and 192,443 passengers during the first six months of the year, as compared with 35,474 and 166,844 in the same period of 1955. Load factors were 52.2% for the first six months and 59.75% for June, 1956.

► **Scandinavian Airlines System** has increased its trans-polar service between the West Coast and Europe to one flight a day. SAS operates four first class and three tourist flights a week between Los Angeles and Copenhagen and other European points, giving the carrier a capacity of 300 tourist and 256 first class seats a week.

► **Southern Airways** flew 15,924 passengers 2,832,555 passenger-miles last month, 11% over June 1955.

► **Southwest Airways** inaugurated its first stewardess service this month and plans to expand the service to all its Martin 2-0-2 flights.

► **Thai Airways** has ordered three Super-G Constellations from Lockheed Aircraft Corp. The transports will be delivered in the summer of 1957 and will have a combination tourist/first class configuration.

► **United Air Lines** has begun a shuttle service across the bay between Oakland and San Francisco with 11 flights a day. . . . United's board of directors declared a regular dividend of 37.5 cents a common share payable September 15 to stockholders on record August 17.

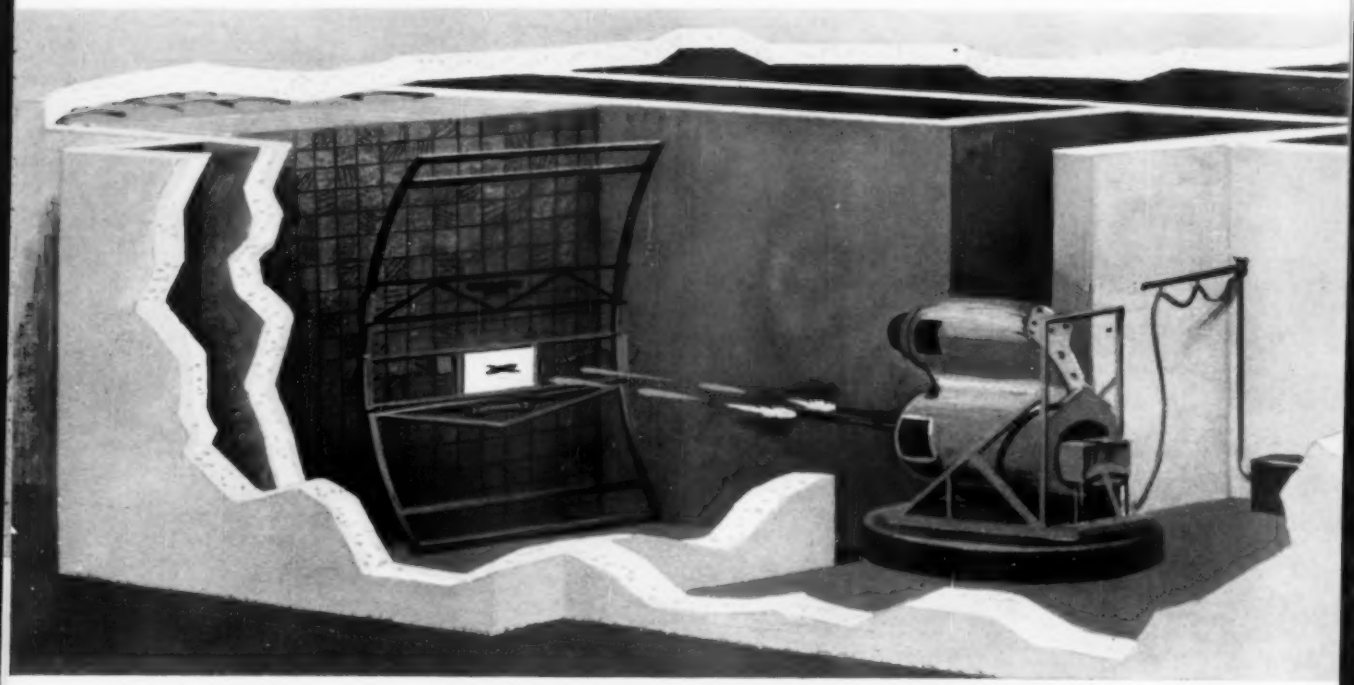
Sperry to Make DC-8 Flight Control Systems

Contracts for first eight electronic flight control systems for Douglas DC-8 jet airliners have been announced. Prototype of a system called the SP-30 is scheduled for delivery by Sperry Gyroscope Co. in the fall. Production models are to arrive by next June. Company says SP-30 will provide precision control between relatively slow speeds of 100 mph. and sonic speeds.

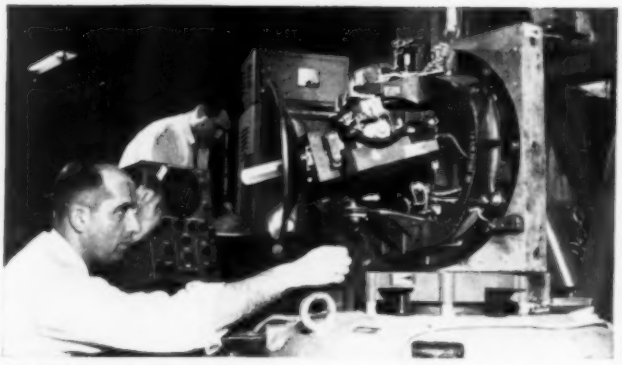
Incorporated in the transistorized systems are such features as inertial path damping, a close altitude and radio guidance control, virtually no-drift gyro for navigation over long distances, simplified radio-beam-coupling equipment, and safety monitors to guard against flight disturbances.

Douglas will begin deliveries of the DC-8 in 1958. Some 114 of the new craft are on order to 11 airlines.

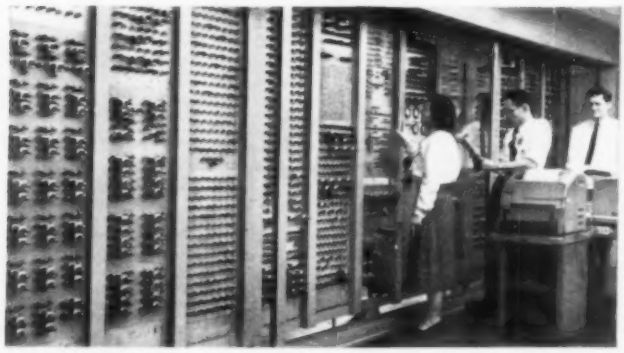
Here's How Facilities at General Electric Speed



ENVIRONMENTAL TEST CHAMBER simulates atmospheric conditions found at altitudes up to 100,000 feet.

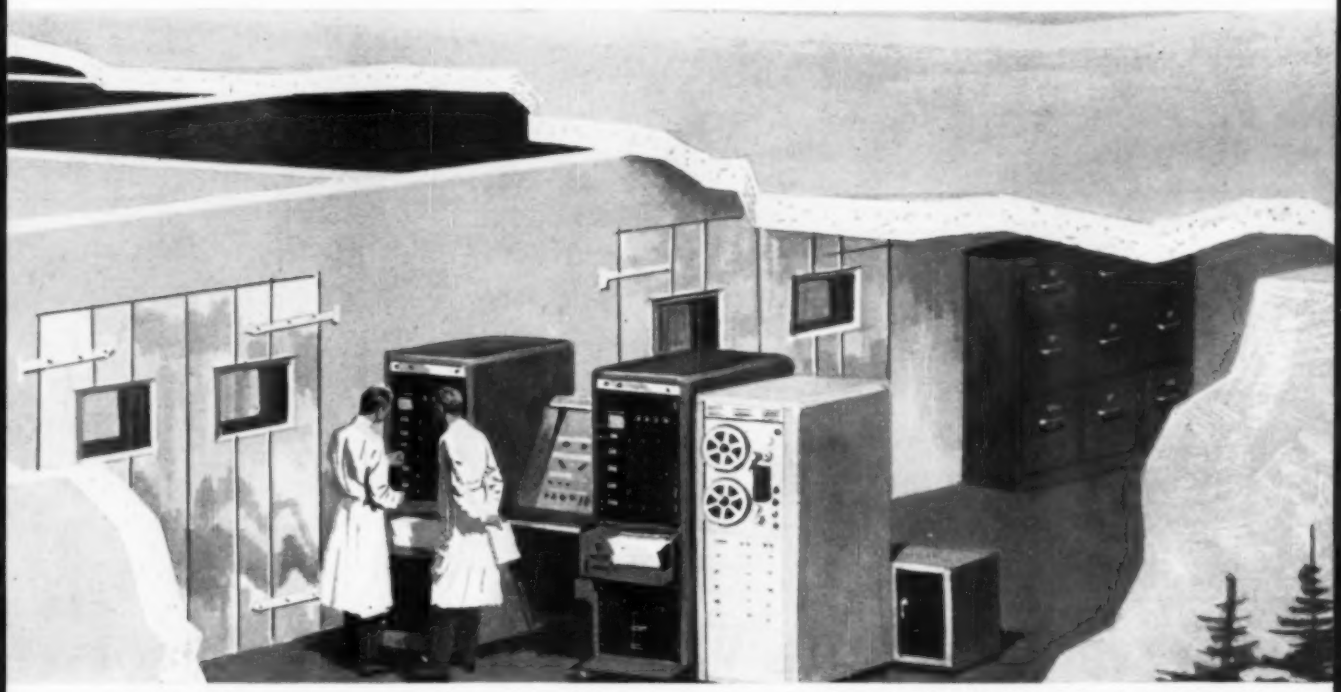


AIRBORNE EQUIPMENT such as the radar antenna being tested here is subjected to severe vibration tests.



DIGITAL COMPUTER, designed and built by General Electric, is used to help solve airborne defense system problems.

Electronic Bomber Defense System Development



DYNAT (**DYN**amic **A**ccuracy **T**ester) simulates flight conditions and combat situations on an indoor test range, minimizing costly flight tests and reducing qualification time. Located at General Electric's Aircraft Products Dept., this installation permits all-angle fire testing of electronic bomber defense systems at temperatures ranging from —100F to 160F.

G-E Facilities Help Researchers Anticipate and Solve Problems Prior to Airborne Tests

Cutting lead time in the development of aircraft equipment has become increasingly important. All possible measures must be taken to reduce development and testing time in order to speed delivery of operational aircraft to our armed forces.

General Electric test facilities provide an important means of reducing development time of airborne defense systems. The test facilities pictured here help experienced G-E personnel to analyze and solve problems difficult if not impossible to duplicate by flight tests. Just as important is the saving in valuable time and reduction in expense of airborne testing. These facilities help make the saving possible—speeding the development of aircraft defense systems for tomorrow.

Engineers: Expanding electronic bomber defense projects at G.E. are creating opportunities for you. Contact C. E. Irwin, General Electric Company, Aircraft Products Department, Johnson City, N. Y. 222-3

Progress Is Our Most Important Product

GENERAL ELECTRIC

CESSNA 310 handles easily on one engine. Care must be taken to maintain proper trim, but headings can be held within 1-2 deg.

Aviation Week Check Ride:

Cessna 310 Flies Well, Quick on Controls

By Richard Sweeney

Wichita, Kan.—In its light, twin executive Model 310, Cessna Aircraft Co. has produced a sensitive, responsive aircraft that has performance to spare. It deserves a full complement of flight and navigational aids plus professional piloting to take advantage of its high capabilities.

Cessna has delivered more than 350 of the Model 310, and production of the airplane is sold out into mid-October, 1956.

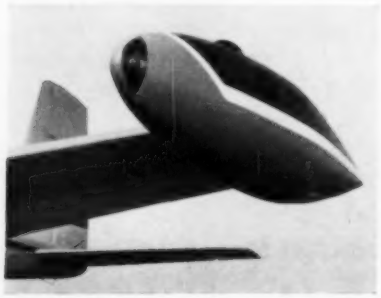
The combination of one of the lowest weight-to-power ratios (9.6 lb. per hp.) in its category, plus the wingtip tanks, makes the 310 a sensitive though in no sense tricky airplane to fly.

Due to the moment and inertia of the tip tanks, the aileron feel of the 310 at first seems to be that of a large airplane. This can lead to the application of more control pressure than necessary to correct for roll in turbulence or wing-low attitude.

It is in the roll axis that smooth and steady control pressures are most necessary.

The axiom is: "Don't fight the tip tanks. Fly with them, not against them."

The 310 is an inherently stable airplane; induced oscillations will damp out if the airplane is properly trimmed. Proper control pressures will keep oscillations from gaining magnitude without inducing overcontrol.



TIP TANKS of advanced design channel airflow over outer wing, make for greater lift.

Nacelle Design

Keynote of the 310 design is efficiency. The engine nacelles, for example, are 21 in. high overall, and their top surfaces generate about 12% of the total lift. The forward part of the fuselage structure, where aerodynamic pressures are high, is flush riveted and completely smooth. The tip tanks act as aerodynamic fences to get more lift from less wing area. Total flat plate frontal area on the 310 is 3.8 sq. ft. Design empty weight is 2,952 lbs. With 645 lb. fuel and oil, and a gross weight of 4,600 lb., the 310 has 1,000 lb. to be distributed between passengers, baggage and optional equipment.

In all flight regimes investigated, the airplane performance exceeded owner's manual specifications. However, minimum single-engine control speed, placarded at 93 mph. IAS (indicated air speed) was not violated.

Altitude capability and cruising conditions were evaluated and a simulated instrument approach was made during a flight from Denver, Colo., to the

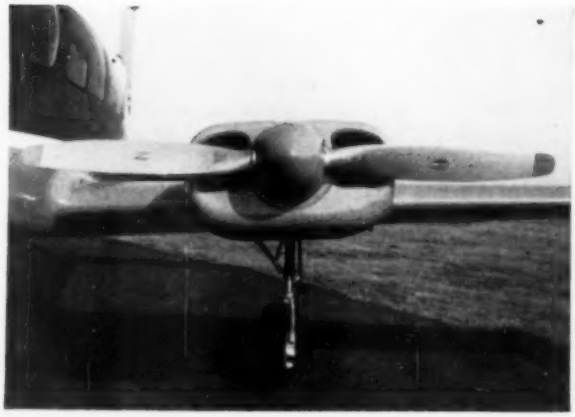
Dick Sweeney

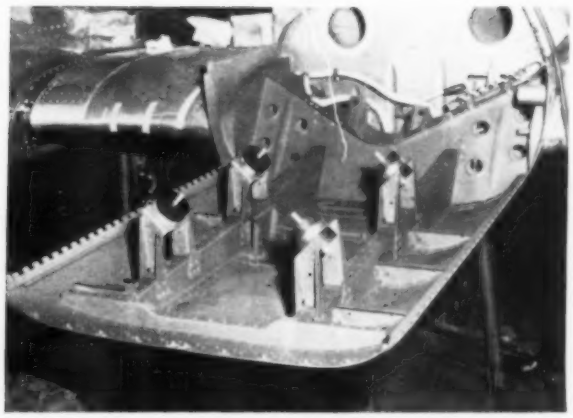
Richard Sweeney of Aviation Week's West Coast Bureau quit keeping track of his flying hours after passing the 5,000 hour mark. He estimates that his log now would total some 6,000 hours accumulated in over 70 types of pre-war, World War II and postwar aircraft.

Dick has flown single and multi-engine personal and executive planes, fighters, bombers, transports and experimental types. The list includes jet aircraft, starting with the Bell P-59A Airacomet.

During World War II, he accumulated 3,000 hours of combat flying time in patrol bombers and fighters of the Royal Canadian Air Force. Later, he served in the Army Air Force as a fighter pilot in Maj. Gen. Claire L. Chennault's 14th Air Force in China. He also was a test pilot in the flight test section at Wright Field.

Claiming his career contains no "hot" items, Dick Sweeney says, "My gray hair comes from raising kids, not airplanes." He has current CAA pilot ratings for aircraft over 12,500 lb.





PARALLEL MOUNTED nacelles mean less cross sectional drag, and their top surfaces generate 12% of total lift. Engines are mounted on built-up sheet metal structures (right). Heavy rubber biscuit-type mounts reduce vibration transmission.

Cessna plant at Wichita. Other flight evaluation maneuvers were done in the vicinity of Wichita and Hutchinson, Kan., which are 1,370 ft. and 1,552 ft. above sea level, respectively.

Cruise investigation covered takeoff, climb to 16,000 ft. for slightly more than one hour cruising, then a climb to 21,900 ft. for altitude evaluation. The right engine was feathered at 21,000 ft. to ascertain the 500 fpm. rate of descent at 100 mph. IAS with the remaining engine at maximum power.

Gross weight approximated 3,800 lb. at this stage of the flight.

Point-to-point flight time was 1 hr., 55 min., for an average ground speed of 213 mph., including climb. True airspeed approximated 190 mph. most of the time at 16,000 ft. with 50% power.

Proper mixture settings and cruising at the higher altitudes combined to give an overall trip average gasoline consumption of 21 gal. diagonal hr., a figure around which it is perfectly safe to build a completely VFR flight plan.

Under CAR Minimums

Civil Air Regulations regarding light twins specify that airplanes with a gross weight of more than 6,000 lbs. or a stalling speed in excess of 70 mph. must comply with standard single-engine inoperative climb requirements. Since the 310 grosses less than required, and stalls at lower IAS, it need not have single-engine characteristics complying with CAR.

But the 310 has good single-engine characteristics. It can be trimmed hands off, turned into the dead engine with gear down without excess loss of altitude and makes climbing turns into or away from the inoperative engine without excess control activity.

In simulated single-engine go around, performed with 4,000 ft. at ground level to compensate for light gross weight, the airplane was easy to hold on course, and when full power was applied to the remaining powerplant for go around, deliberate slowness in cleaning up the airplane showed it will climb at 300 ft./min. in the wheels-down configuration. Cleaning up the aircraft gave a 500 ft./min. rate of climb. Left-hand traffic was used, with the left engine feathered. Standard pattern entry and leaving tracks were followed.

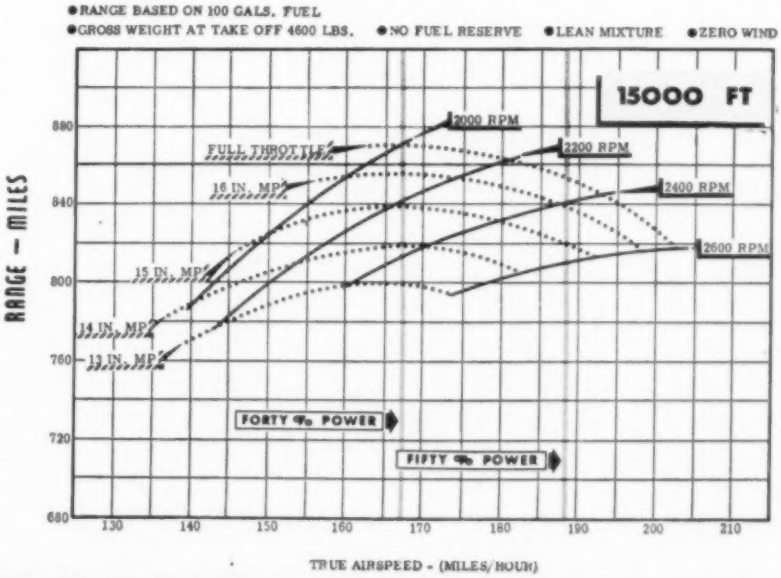
Light on Controls

As in all cases of single-engine flight, close attention must be paid to keeping proper trim for zero or very light control pressures to maintain the desired flight path.

An unexpected aspect of single-engine control in the 310 is that headings can be held within 1 or 2 deg. at en-

Cessna 310

Span	36 ft.
Length	27 ft.
Height	10.5 ft.
Gross wing area	175 sq. ft.
Gross weight	4,600 lb.
Useful load	1,700 lb.
Wing loading	26.2 lb./sq. ft.
Power loading	9.6 lb./hp.
Fuel capacity	100 U. S. gal.
Oil capacity	6 U. S. gal.
Powerplants	2 Continental 0470-M @ 240 hp. each, normal rated @ 2,600 rpm.
Basic price	$54,950 f.a.f., Wichita



PERFORMANCE CURVES for 310 show range and airspeed at various power settings.

gine feathering with aileron alone, feet on the floor.

The airplane was put through a practice ILS approach at Wichita Municipal Airport. Although the demonstrator was equipped with approach coupler, a manual approach was used. In this maneuver, steady and smooth control pressures are important.

Stall Warning

In stalls, the airplane entered buffet well ahead of complete stall. Warning horn reaction was frequently more than 10 mph. ahead of actual stall. The airplane breaks clean in power-off stalls, with little or no lateral or longitudinal wandering tendency. Full power application naturally calls for yaw correction, but application of cruise power necessitated very slight yaw correction.

Using the stall recovery technique backed by CAA—dropping the nose only to the horizon and applying power—the 310 can effect a power-off stall recovery with less than 100 ft. altitude loss from top of the stall. The same technique applied to a cruise power stall yields a 10 to 20 ft. altitude loss.

Recovery from a power-off stall using standard technique—dropping the nose below the horizon and applying power to reach safe speed as quickly as possible—gives a complete stall recovery in less than 500 ft.

In short field technique, taking advantage of 15 deg. flap maximum lift setting, the airplane can become airborne at lighter gross weights in 500 ft. Climb over 50 ft. obstacle can be accomplished in just over 1,000 ft. if the airplane is cleaned up quickly after becoming airborne. Maximum flap, low IAS power approaches make it possible for the 310 to be landed and turned off the active runway within 600 ft. At maximum gross weight, both takeoff and landing distances increase somewhat.

FLUSH riveted fin area has balanced controls.

Quick Acceleration

The 310 performs well on both takeoff and landing. The clean design gives quick acceleration, and the airplane becomes airborne quickly. The plane can be pulled off the ground in a hurry around 65 mph. IAS, or it can be flown off gently with slight back pressure around 80 mph. No flaps are used in conventional takeoff . The tricycle gear gives good stability until airspeed is adequate for rudder effectiveness.

The standard light twin landing technique is best with the 310, that of using power on final approach and cutting it at the flareout. Flap use, outside the five deg. applied to offset trim change when the gear is lowered, is usually dictated by atmospheric conditions of wind, temperature, pressure altitude of the field. Smoothness and no over-control are important on final approach.

Many twin engine airplanes are started with fuel boost pumps on, mixture in idle cut off. The 310, with its down draft carburetors, reverses this procedure. Starting is with boost pumps off, mixtures full rich. If the engines are slow starting, a shot of boost usually gets them going.

Overloading can happen quickly with this type induction system, and if it is suspected the engine is flooded, it is best to wait a few minutes for the fuel to dissipate before trying the start again.

With the electrical switches set in line, this part of starting is easy. Starter button-boost pump switch locations are close and easily manipulated in the starting sequence. Cessna engineers are investigating a change of procedures to the idle-cut-off and boost-pump-on system, since most pilots are used to that system.

On the ground, the 310 is adequately controlled by the steerable nose wheel. If severe turns are to be made, brake and engine can be used. With the power available, care is to be used in using the engines as steering aids.

Structurally, the 310 has a high aerodynamic pressure structural area (forward fuselage) designed for minimum drag. The engine nacelles employ several unusual techniques.

First consideration was streamline, small frontal area and effective cooling. Built-up sheet metal structures carry the engines. Essentially, the design consists of two channel sections of heavy-gage metal, two lateral stiffening frames, and stressed skin, combined with a transverse bracket tying into the front wing beam as a load transmission structure. The engine is mounted on the structure with heavy rubber biscuit-type mounts to reduce vibration transmisson. In addition, the nacelle structure, fabricated on a jig, extends into the wing as underside structure, further spreading the loads into the main wing.

Costs Reduced

Cessna finds that overall costs have been reduced by the sheet metal mounting system, compared with tubular steel. In certain parts of fabrication, costs are higher, but when all costs including labor are taken into account, the sheet metal system comes out ahead, to say nothing of the better streamlining that would have been impossible with tube steel. Another feature is that cowlings are integral for strength to take the lift loads generated. They make for time saving in that they do not have to be assembled and installed separately.

Exhaust augmenter tubes are used to aid engine cooling. In the latest version of the 310, which has the large biscuit engine bearers, double windows

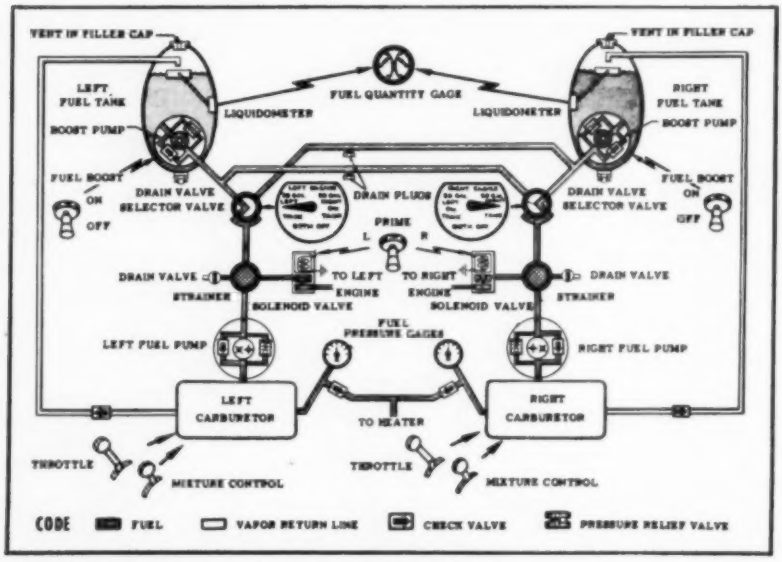


DIAGRAM shows details of fuel system of the 310.

"Man's reach should exceed his grasp, or what's a heaven for" – Robert Browning

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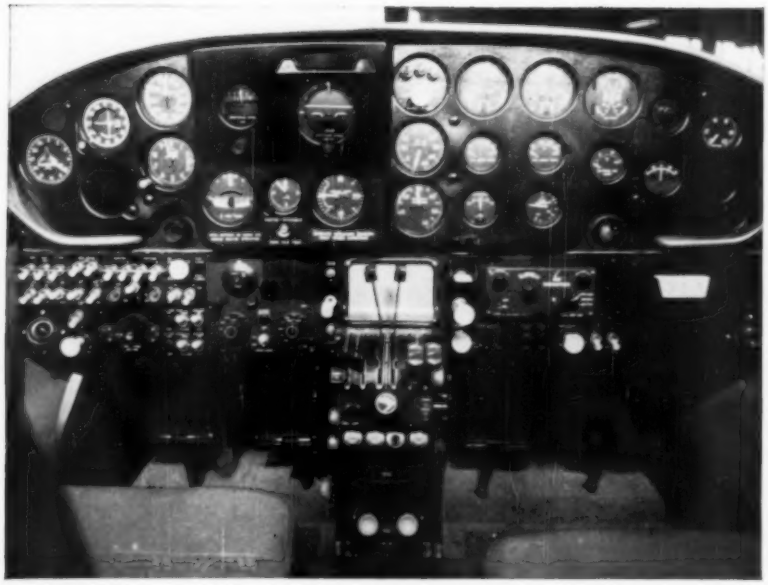


INSTRUMENT panel of 310 is flexible, providing space for several combinations, including dual omni and gyros. Flight group is left, engine group right.

are installed in the rear of the passenger compartment to offset the augmenter noise.

Racks Installed

Cessna builds in at the factory all racks for optional equipment, radio and oxygen, whether or not the buyer specifies any installations. Rack for the Scott oxygen system, a 2,100 psi. bottle and regulator which reduces flow to low pressure at the four outlets, is installed behind the baggage compartment. There are racks for marker beacon receiver and other radio-electronic equipment, including autopilot. Racks for remaining optional electronic gear are forward of the passenger compartment.

Since the first 310 was sold in 1954, the plane has undergone few major changes. Of these, the majority were for psychological reasons or customer comfort, Cessna engineers say.

Near the wingtips, although no excessive torsional or bending loads were being incurred, skin thickness was raised one gage to avoid giving the impression of more than usual structural aeroelasticity. Corrugation was added under the wing skin in the wheel well area to prevent oil canning. The structure limits did not call for stiffening.

Forgings replaced welded components in the landing gear when it was found that faster retraction could be achieved with the plane's electromechanical system, as well as weight and cost saving. A safety switch was wired into the warning horn system and hooked to the left landing gear. It sounds if the landing gear operating switch is placed in the "up" position while the airplane rests on the ground. A weight limit switch keeps the gear from folding while the plane rests on the ground.

Cabin door closings were beefed up and changed to double (top and bottom) locations. Cowl skin was increased one gage as a vibration reduction measure. One performance factor change involved reducing propeller diameter from 84 in. to 80 in. Smaller props deliver the thrust necessary, and at the same time the prop tips are two inches farther from the ground during engine runups.

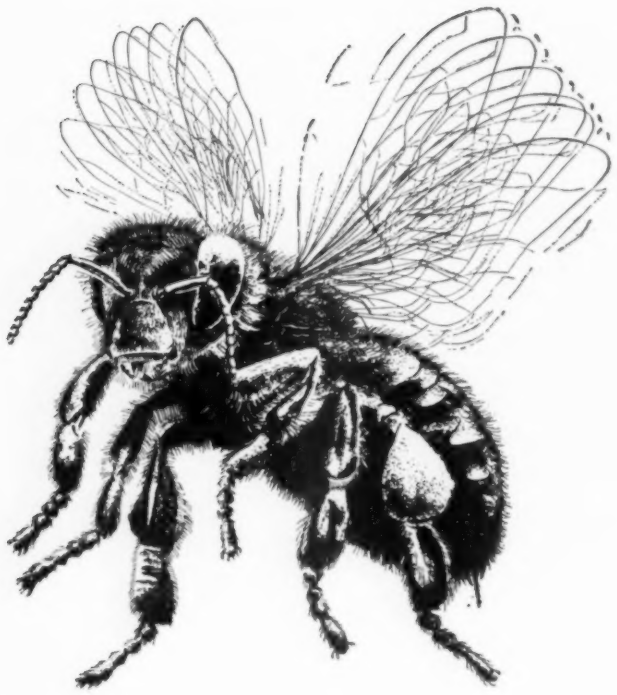
Continental contributed a modification in the 240 hp. Continental 0470-M engines powering the 310. To prevent accidental fuel loadups and to drain excess fuel when engines are flooded at starting, automatic drains are placed in the lowest spot in each intake manifold rather than in the central spot where drains did not always completely eliminate raw gas in the manifolds and sometimes caused heavy backfires.

Full Panel

Instrument-wise, the 310 comes equipped with a full panel as standard. Optionally, Cessna offers one winterization installation which includes deicing for wings, tail surfaces and propeller, auxiliary electrically driven gyro flight instruments and assorted electronic and radio gear priced at $33,925.

The demonstrator used in the evaluation carried the company's Group 2-C optional equipment plus a Safe Flight Speed Control Instrument system, with a total installed weight of 262 lbs.

Some 70% of 310s delivered leave the factory with approximately $20,000



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worth of optional equipment installed, including a Lear L-2 autopilot, single or dual Aircraft Radio Corp. VHF 15-D navigation system, ARC T11-B transmitter, Lear LVTR-36 transceiver, Lear ADF-12 or -14 radio compass, Lear 2200 marker beacon receiver, Scott oxygen system, rotating beacon, auxiliary landing light and tail light. The installations weigh from 228 to 249 lb.

A second popular lineup containing all the elements necessary for minimum consistent IFR operations costs about $9,000 and does not have the autopilot, second ARC VHF 15-D, or several other items, and weighs about 128 lbs.

Most individuals or business concerns investing $59,950 FOB Wichita for a Cessna 310 feel that a full complement of equipment for maximum utilization makes good sense. Cessna has found that 80% of the 310s delivered are being flown by professional pilots employed by the owning individuals or companies. Common sense dictates realization of all-weather operation consistent with the initial investment and safety.

The 310's range of better than 800 mi. at average cruising covers about 4 hr. airborne. Cessna investigated extending the range and found that business airplane range is geared to how long an owner desires to stay aloft at one time. Stops for a sandwich and washing up about every four hours seemed to be the preferred system. For owners who require longer range, the company has developed auxiliary fuel tanks located in the wings.

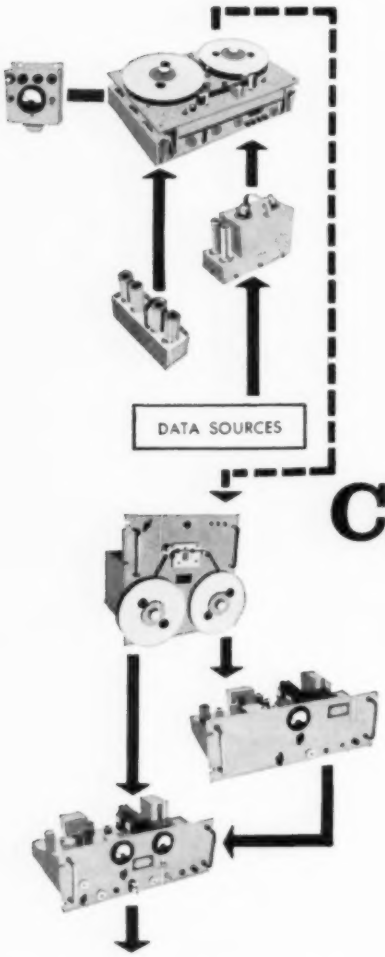
PRIVATE LINES

New Learstar orders by Sinclair Refining Co. and W. R. Grace & Co. extend Mk.1 production through February 1957.

Specially modified DC-3 operated by Hunting Geophysics Ltd., England, carries a magnetometer, electromagnetic detector and scintillation counter. All can be operated simultaneously. Not only can the three types of vital data on subsurface ore deposits be measured along the same flight line, but they can be compared, allowing confirmation of one or more readings quickly, the firm notes.

Ontario no longer allows private pilots who make emergency landings on highways to take off from these areas. In the future, planes must be towed away, the Ontario Department of Highways rules.

AiResearch Aviation Service, Los Angeles, Calif., is a distributor for Aerojet-General Corp.'s aircraft auxiliary take-off rocket motors for installation on



In choosing data recording equipment, it is now feasible to tailor the equipment to present and future data handling needs. It is no longer necessary to tailor your entire program to equipment limitations.

Choosing A System

for magnetic tape DATA recording

When magnetic recording was in the audio phase of its development, there was just one recording method —direct recording. But today, several methods are available. And while direct recording is still common in audio work, it has taken a back seat to modulated carrier techniques in the more critical field of *data* recording.

To take advantage of the broad range of equipment and techniques now available, start with a thoroughgoing analysis of your own present *and future* data handling . . . data processing needs. Then, match the techniques and individual components *to those needs.*

Choose the recording method first: Direct recording is limited in data work by its poor amplitude reproduction and poor low frequency response on playback. Pulse width modulation (PWM) recording is excellent for recording a large number of channels with limited frequency response. Digital recording offers extremely high data accuracy, but relatively low information capacity.

FM recording, electronically compensated for wow and flutter, offers a combination of high overall system performance, frequency response, and information capacity, suiting it for most analog recording applications. Any or all of these methods can be supplied in the same recording system by inserting the proper plug-in circuitry.

Consider physical requirements next: Where you plan to use a system is an extremely important factor. To record data in a missile or jet, you will obviously need different equipment than would be used in a laboratory. But reel size, tape width, tape speeds, must also be selected. And heads, available for recording from 2 to 24 data tracks or even more, should be specified early. Keep in mind also the planned final disposition of the data, whether to a computer, direct writing recorder, or other equipment.

Finally, select system components and accessories: In FM carrier recording alone, you can choose from at least three recording oscillators, two reference generators, and several signal and compensation discriminators. Speed control servos, power supplies, and remote controls also require attention.

Needless to say, much of this process of selection requires special experience, and should be placed in the hands of the competent data recording systems manufacturer. But the important thing to remember is that data recording on tape is a field in itself, with special techniques and special equipment that can be matched to virtually any recording need. The day when the problem had to be tailored to the equipment is long past.

More detailed information on recording systems and equipment, and how to select them, is provided in "The Role of Magnetic Tape In Data Recording," available on request to Davies Laboratories, Inc.

Davies

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business airplanes as an emergency power source.

Dallas Airmotive, Tex., engine overhaul specialists, opened New York offices in La Guardia Airport's Marine Terminal Building.

Beech distributorship for most of Nebraska, western Iowa and part of South Dakota has been granted Lang Aircraft, Omaha.

Contract to provide helicopter service in East Greenland has been awarded Autair, Ltd., London, by a Danish mining company. Autair will operate two Westland-Sikorsky S-51s to ferry mine technicians.

Cessna is entering the commercial helicopter field with its four-place CH-1. Civil deliveries will start in early 1958.

Short Flight Course Developed by School

A streamlined flight course, aimed at developing aviation interest among businessmen and teachers, has been refined by the University of Illinois Institute of Aviation.

The syllabus includes 10 hr. of flight, two hours of flight observation, two lecture hours and two hours of ground observation. The flight training goes to the solo stage and includes cross-country work, at least one landing at small and large airports, demonstration and instruction in a contact flight trainer or simulator.

The Institute has developed the short course over several years and reports that many students have continued their training, enlarging the business of local operators.

The course developed by the Institute requires three flights a week for four weeks. Price depends upon the equipment used. The Institute provided the courses on a non-profit basis for teachers at a charge of $75. Used were Aeronca 7-AC trainers and Cessna 140s for transition, a Beech Bonanza for cross-country work.

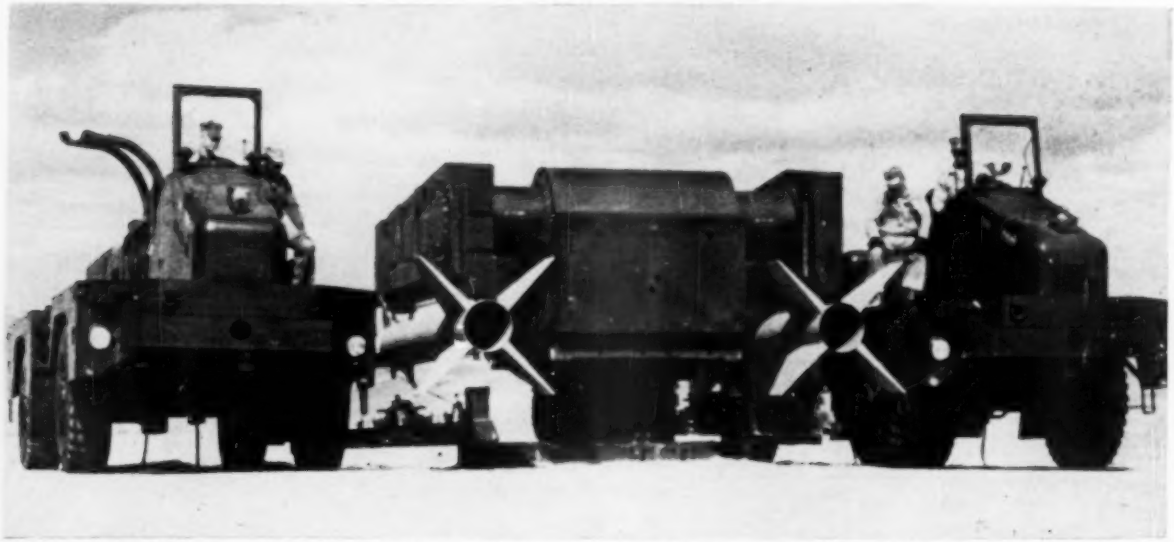
Details of the syllabus are available from the Institute of Aviation, University of Illinois, Urbana.

New York University Offers Airline Courses

New York—Courses for training aircraft dispatchers, commercial pilots, air traffic control-control tower operators and ground school instructors will be offered at night by New York University School of Education in the term beginning Sept. 24. Those interested can communicate with Prof. Roland H. Spaulding, Barney Building, 34 Stuyvesant St., New York 3.

Terrier Is Fired on Mobile Launcher in Marine Training

CARGO TRACTOR tows unloaded launcher for Convair Terrier to Marine training site.



TWO TWIN CARRIERS for anti-aircraft missile flank mobile launcher and load live rounds into unit, which has been towed into position on concrete ramp. Site for Marine Corps training with loader is China Lake, Calif.

LAUNCHER is energized (left) by Marines on truck. Tilted terriers (right) track an F6F drone on incoming course.

Terrier is fired from mobile launcher . . .

. . . explodes off left wing of drone . . .

. . . which begins to burn after hit . . .

. . . and quickly disintegrates.

NEW 8 CHANNEL

Sanborn oscillographic recording system

THIS new self-contained 8-channel oscillographic recording system, primarily for (but not limited to) analog computer recording, measures only 46½" x 27" x 22". In a single, space-saving mobile package, the user has a complete system for analog computer readout recording. Input cable connections are easily made at the top of the back panel. Eight groups of controls for the eight channels are conveniently located on the sloping top panel. Driver Amplifier chassis are easily withdrawn from the lower part of the console for inspection. Paper loading is quickly done from the top.

Features of the Model 158-5490 system include 0.1v/cm to 100v/cm sensitivity; over-all linearity of 0.25 mm over the entire 4 cm of the chart; drift less than 0.5 mm/hour; push-pull or single-ended input; miniaturized dual-channel DC amplifiers of improved current feedback design; 5 meg. input impedance each input lead to ground; true rectangular coordinate recording; nine chart speeds from 0.25 to 100 mm/sec. Frequency response is flat to 20 cps, down 3 db at 60 cps for all amplitudes to 4 cm peak to peak.

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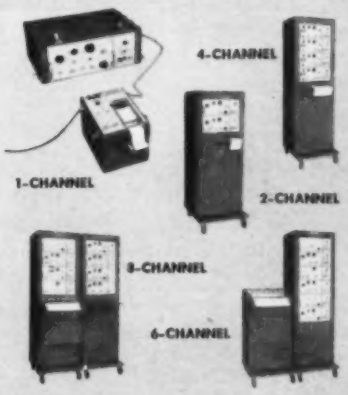
COMPLETE COMPACT SELF-CONTAINED

FAMOUS "150" SYSTEMS
. . . for all recording requirements



In laboratories, production testing facilities and field installations nationwide Sanborn 150 Series Oscillographic Recording Systems are proving their versatility and value. Users have a choice of basic systems ranging from 1 to 8 channels . . . "packaged" as portable units or in vertical mobile cabinets . . . and twelve interchangeable plug-in preamplifiers permitting rapid, economical changeover to new input requirements.

Sanborn will gladly furnish complete descriptive data on the new 158-5490 System and all "regular 150" systems, or engineering assistance on your recording problems, whenever you wish. Contact your Sanborn Representative, or write to

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TAKE-OFF POWER

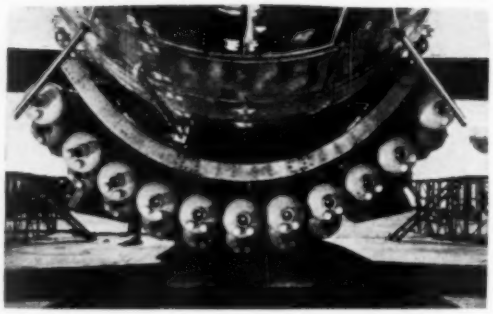
BY PHILLIPS 66

The M15 JATO . . . developed and manufactured by Phillips Petroleum Company . . . uses a solid propellant made from petroleum raw materials.

In the photo above, 30 M15 JATO rockets give a Boeing B-47 Stratojet medium bomber a take-off assist. Use of these rockets permits greater in-flight payloads as well as operation from smaller airfields.

The Phillips M15 JATO operates successfully in the temperature range –75 F to 170 F. Propellant for the M15 rocket is but one in a series developed by Phillips from common petroleum-derived materials such as ammonium nitrate, synthetic rubber and carbon black. These propellants are insensitive to detonation by impact or explosion. Exhaust gases are noncorrosive and relatively low in temperature.

Solid rocket propellants in the Phillips series are readily usable for a variety of rocket applications from small armament rockets to very large boosters. Phillips operates extensive facilities for rocket research, development, test, and manufacture.



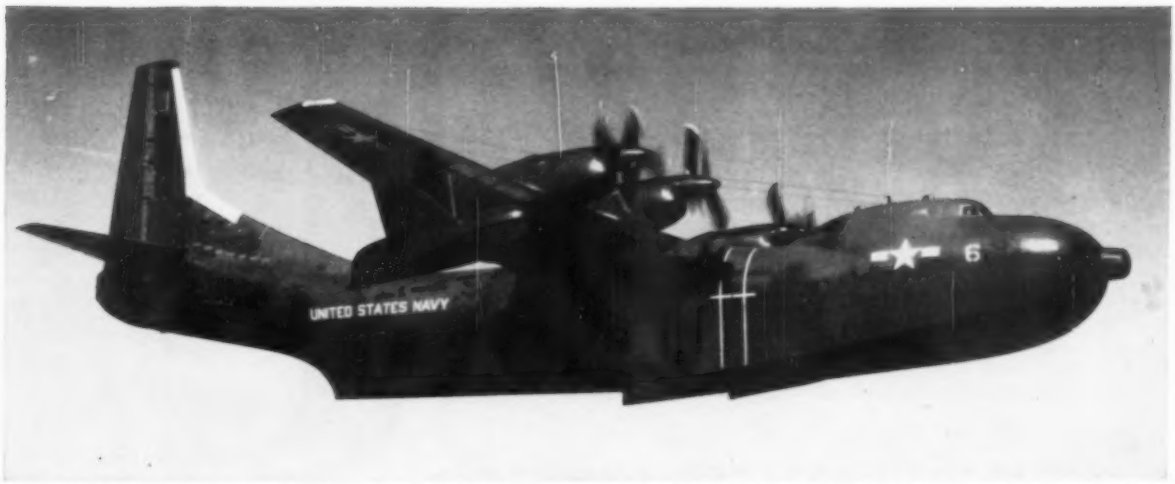
Can our staff of highly skilled rocket scientists help you solve your complex problems in propulsion systems, primary rockets, booster rockets and related activities? Inquiries are invited.

(Photos courtesy of Boeing Airplane Company)

PHILLIPS PETROLEUM COMPANY

Bartlesville, Oklahoma

Address all inquiries to: **Rocket Fuels Division, McGregor, Texas.**



R3Y-1 TRADEWIND is powered by four Allison T40 turboprops rated at 5,500 eshp. Overall length is 142.5 ft., wingspan 145 ft.

Convair Nears End of Tradewind Contract

Final deliveries of 11 Convair R3Y-1 Tradewind, turbo-powered blended-hull flying boats, will be completed this year to Navy Squadron VR-2, probably ending one of the more original concepts in water-based aircraft design.

Fifth plane in the small production order should be delivered to the squadron this month. The remaining six on the line at Convair's San Diego plant will be rolled out before December.

With no present plans for additional orders, the final delivery will call a halt to a program which—after long development troubles—finally got out of the woods.

Both Navy and Convair see a long life ahead for the Tradewind. Some observers have compared it to the program that produced only one XC-99 freighter modification of the Convair B-36. The XC-99 is still operational nearly a decade after its delivery, and still is carrying more cargo longer distances than any other airplane.

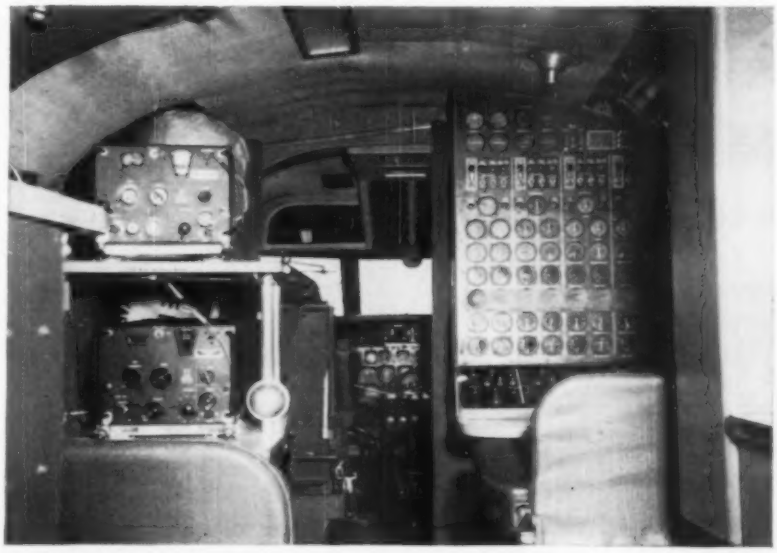
VR-2 also operates the Martin Mars, giant four-engined seaplanes with a similar life history.

Major problem with the Tradewind was its intended powerplant, the Allison T54, which the Navy never got around to sponsoring. As substitutes, Convair engineers called for the Allison T40, coupled turboprop engine made by hooking the power-producers of two T38s into a single gearbox.

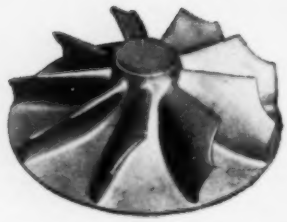
But the T40 turned out to be somewhat deficient in power at altitude and in fuel consumption. Convair contributed further with an overweight airplane, and for a while the entire program looked as if it were to go down the drain.

A redesign of the basic airframe was pushed through the San Diego engi-

ON THE STEP, Tradewind shows the sleek lines of the blended-hull configuration.



FLIGHT DECK of Tradewind shows compactness of crew positions.



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"Design with Microcast in Mind," Austenal's latest informative booklet, tells you how to get the greatest benefit from investment casting. *Write for it today.*

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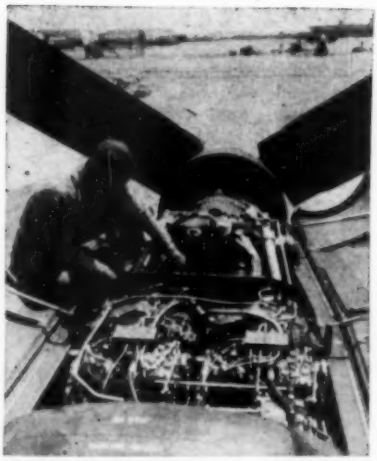


T40 NACELLE opened for access shows compact complexity of the powerplants.

neering department, aimed at adding 10,000 lb. payload capacity to the airplane.

The intent was that when bigger would be ready to handle them and to have extra payload besides.

Actually, the additional capacity just compensated for the powerplant deficiencies, so that the airplane finally made its design specifications.

An experimental version of the R3Y-1 was built around a bow-loading door. The entire front of the plane tipped up to disgorge the contents of the long hull.

There has been great interest in this design, designated the R3Y-2, by both Marines and Army, who see such a concept as probably the only feasible solution to their amphibious assault problems. But interest is one thing and procurement money is another, and so far, all Convair has seen is the interest.

The R3Y-1 Tradewind is powered by four Allison T40 turboprops rated at 5,500 eshp.

Wingspan is 145 ft.; overall length is 142.5 ft. Tip of the vertical tail towers 51.5 ft. above the ground.

CL-28 Skips Prototype, Is Near Final Assembly

Prototype stage is to be eliminated in the CL-28, the Canadair maritime reconnaissance version of the Bristol Britannia, and the first aircraft now nearing final assembly at the Montreal factory is the production model.

The CL-28 is scheduled to fly early next year with Wright turbo-compound piston engines, not turbine engines as in the Britannia. Like the Britannia, the CL-28 will have a wingspan of 142 ft., but the fuselage length has been increased from the 114 ft. of the Mk. 100 Britannia to 122 ft., 2 ft. shorter than the Mk. 300 Britannia.

With piston engines, chosen for maximum economy, the CL-28 will have an endurance of 24 hr. and a crew of 15. Maximum all-up weight will be slightly less than the 150,000 lb. of the Mk. 100 Britannia.

Titanium is being used for the first time in a Canadian airframe, the company reports. It replaces stainless steel in the engine firewalls. The 600-900 lb. of titanium per aircraft replaces 1,800-2,700 lb. of stainless steel.

All wing and tail surface structural drawings have been redrawn to American standards, and North American equivalents established for all materials and parts. With this exception, the wing, tail surfaces, landing gear and the servo-tab free-floating-surface primary flight control system of the Britannia are unchanged in the CL-28.

The original RCAF order for 13 aircraft has been increased, but the number has not been disclosed.

Bristol, which has its own Canadian subsidiaries, will overhaul Proteus engines of the ten Britannias purchased or on option by Canadian Pacific Airlines at the plant of Bristol Aero-Engines (Western) Ltd. The Vancouver plant, being expanded now, will have Canada's largest turboprop test cell, designed for engines up to 6,500 hp.

Valve Talk

FOR WM. R. WHITTAKER CO., LTD.
BY MARVIN MILES

(Rerun by special request)

If his desk is loaded with correspondence . . . If his secretary's waiting patiently with a half-completed letter in her notebook . . . If he's busy on the phone, with three or four calls holding . . . If there are visitors in his office and others lined up outside . . . he's a buyer — the guy who for a modest salary spends millions of dollars for his aircraft company each year, saves the firm untold expenditures and gets blamed for all shortages, late deliveries, and other troubles, with rarely a pat on the back for a job well done.

He's a man who is paid for a 40-hour week, although he averages more like 50 hours – including Saturdays. He has to, for he's expected to complete the mountain of work that's piled on his shoulders.

His salary ranges in the vicinity of $500 to $700 a month, but in any one year he may write 10,000 purchase orders totaling perhaps $15,000,000 to buy thousands of items from hundreds of different suppliers.

And in this buying, he may, by skill, ingenuity and knowledge, be responsible for savings in the millions. In fact, a favorite pastime among aircraft buyers is to tote up and compare the savings they have made for their companies.

A dedicated man, personally proud of the job he accomplishes, the average equipment buyer has been at his task for 10 years or more, having won the job through experience in follow-up, expediting and assistant buyer classifications.

He knows metals and materials, products, producers and prices. Hundreds of contacts are at his fingertips and within his own organization he works with engineering, materiel, inspection, receiving, shop, shipping, the laboratories, the release group, traffic, etc.

Everyone with whom he deals expects him to be – and by and large he is – an endless source of information on each of the thousands of items he procures.

It's an ulcer-building job, but the buyers seem to enjoy the challenge of juggling dozens of phone calls each hour, perhaps fifteen office visitors each day. They gripe about the bales of paper work involved, but in the same breath they thank their fates for dependable vendors, the efficiency of their secretaries and assistants, the expediters, the follow-up men and the assistant buyers who handle thousands of cluttering details.

Clobbering their work continually are such major and minor irritations as re-scheduling, engineering changes, revised specifications, impossibly short lead times for new procurement, failure of suppliers to meet shipping schedules, foul-ups by inefficient vendors, price increases, salesmen who hang around the office to chat after completing their business, visiting dignitaries who use up valuable time and – worst of all – corny jokes. These boys have heard them all, so if you've got one it better be good.

In rare instances, buyers receive tempting offers by unscrupulous vendors who hope to buy business with gratuities.

But you'll find most every buyer is a "company man" and not about to sell out his integrity, his pride and his firm to the glib salesman of an inferior product. The vendors who attempt to bribe are consistent losers.

There's only one worry about a good buyer as far as his company is concerned. Because he's capable, quick-thinking, analytical and smooth-talking, with years of experience to boot, he can sell as well as he can buy. Suppliers recognize this and many a buyer has reversed his field to turn salesman and apply his abilities for a vendor in the perfect counterpart of his original job.

Yet, as I have said, these capable, hard-working men seldom receive the kudos they deserve. Not that their accomplishments aren't appreciated. It's just that they are expected to do a top job and they invariably measure up to expectations.

From Whittaker, then, a pat on the back to the buyers.

"Well done!"

USAF Takes Delivery of First Wichita B-52

Wichita–First B-52D delivered to the Air Force from the Boeing Airplane Co. Wichita plant under the second source program was flown the 1,400 mi. from McConnell Air Force base at Wichita to Castle Air Force base near Merced, Calif., in 3 hr. and 11 min.

Crew from the 93rd Bomb Wing of the Strategic Air Command took the delivery, which was on schedule. The Wichita plant was officially named as second source in October, 1953, and rolled out its first B-52D on schedule in December, 1955.

The B-52D, built at the Wichita Division only, is exclusively a long-range bomber. The B-52C can be used for reconnaissance.

With the B-52 delivery came the announcement that the B-47 Production committee, which has coordinated the manufacture of more than 1,600 B-47s, has been disbanded. The committee, which included USAF and subcontractor representatives, had its headquarters at Wichita.

T2V-1 Patuxent Tests Will Begin in August

Burbank–Sixty-day evaluation of the T2V-1 SeaStar carrier based jet trainer (AW, April 23, p. 62) will begin in August at the Naval Air Test Center, Patuxent River, Md. Earlier estimates had called for the evaluation to get under way in May or June.

Navy pilots have begun the second flight checkout at Burbank and their recommendations will be incorporated in the planes sent to Patuxent. The first Navy checkout was done last March.

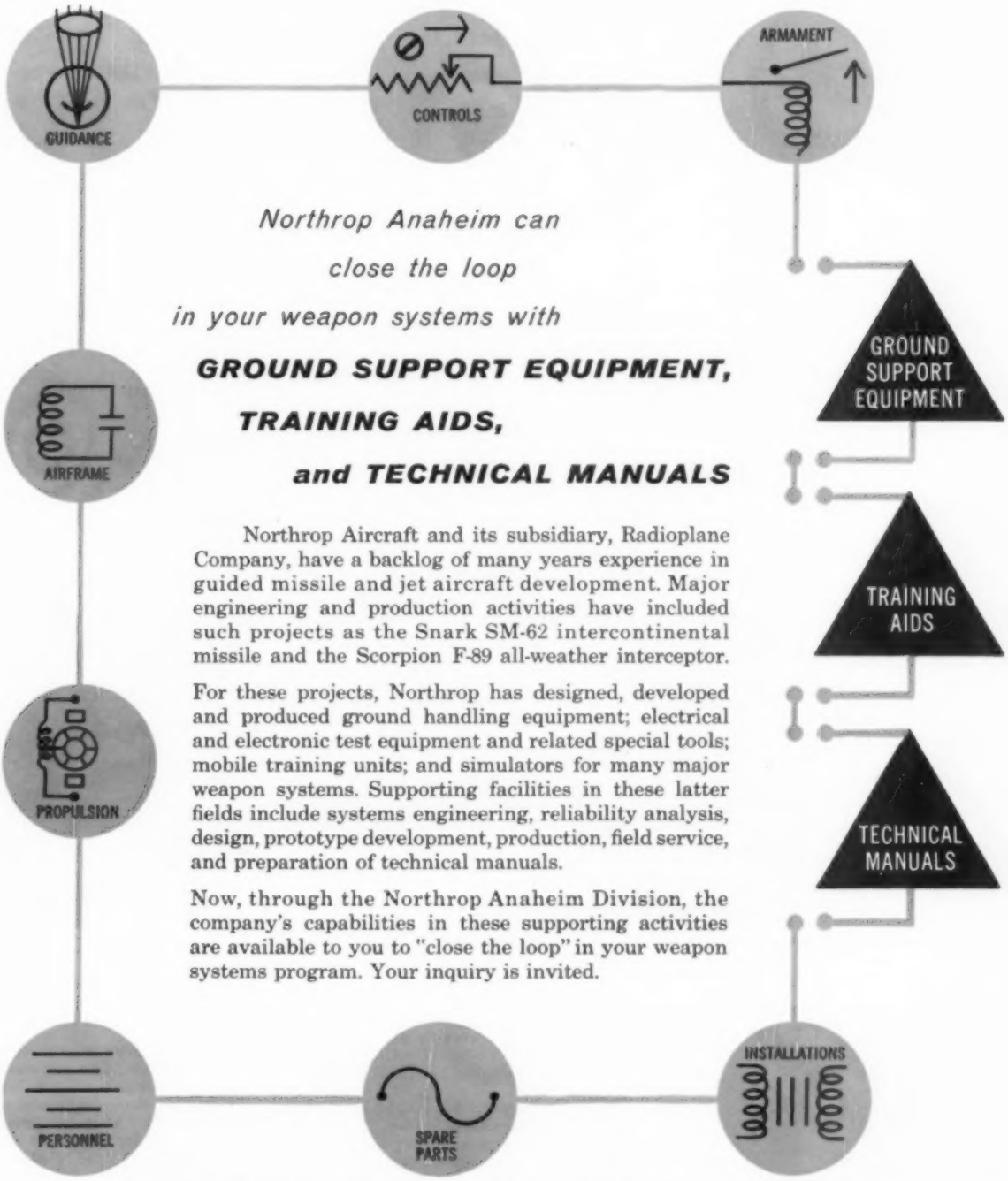
Engineering flight demonstration tests for stability and control, powerplant and spin characteristics continue on the first production model. The second is being used for static tests, the third for structural buildup tests.

B-57 Grounded

Washington–USAF's tactical and reconnaissance Martin B-57 twin-jet bomber has been grounded.

The action was taken to allow time for a permanent correction of trouble with the horizontal stabilizer actuator. Work is being pressed by the Air Materiel Command and Martin.

The B-57, USAF version of the British Canberra bomber, has been operating at restricted speeds and altitudes since the problem first came to light in January. The plane is powered by Wright J65 jet engines.



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Northrop Aircraft and its subsidiary, Radioplane Company, have a backlog of many years experience in guided missile and jet aircraft development. Major engineering and production activities have included such projects as the Snark SM-62 intercontinental missile and the Scorpion F-89 all-weather interceptor.

For these projects, Northrop has designed, developed and produced ground handling equipment; electrical and electronic test equipment and related special tools; mobile training units; and simulators for many major weapon systems. Supporting facilities in these latter fields include systems engineering, reliability analysis, design, prototype development, production, field service, and preparation of technical manuals.

Now, through the Northrop Anaheim Division, the company's capabilities in these supporting activities are available to you to "close the loop" in your weapon systems program. Your inquiry is invited.

For immediate consultation on your problems, contact Mr. Thomas H. Quayle, Division Manager, Northrop Anaheim, 500 East Orangethorpe Ave., Anaheim, Calif.

NORTHROP ANAHEIM

Specialists in weapon systems support, opto-mechanical fire control systems, and armament propulsion and explosive mechanisms.

NA-1-56

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Meeting of the board

This is a briefing for action! The chairman is a squadron leader...he is responsible for today's show. The mission is gunnery. His hands talk in jet-age language as he describes a high altitude target approach.

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City.....*Zone*....*State*.....

CE-11

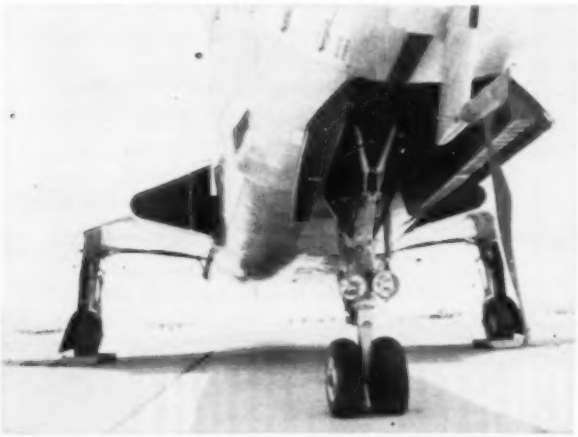
CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

DESIGNER AND BUILDER OF HIGH PERFORMANCE MILITARY AIRCRAFT SINCE 1917

F-101 Intake, Seals Designed for Supersonic Flight

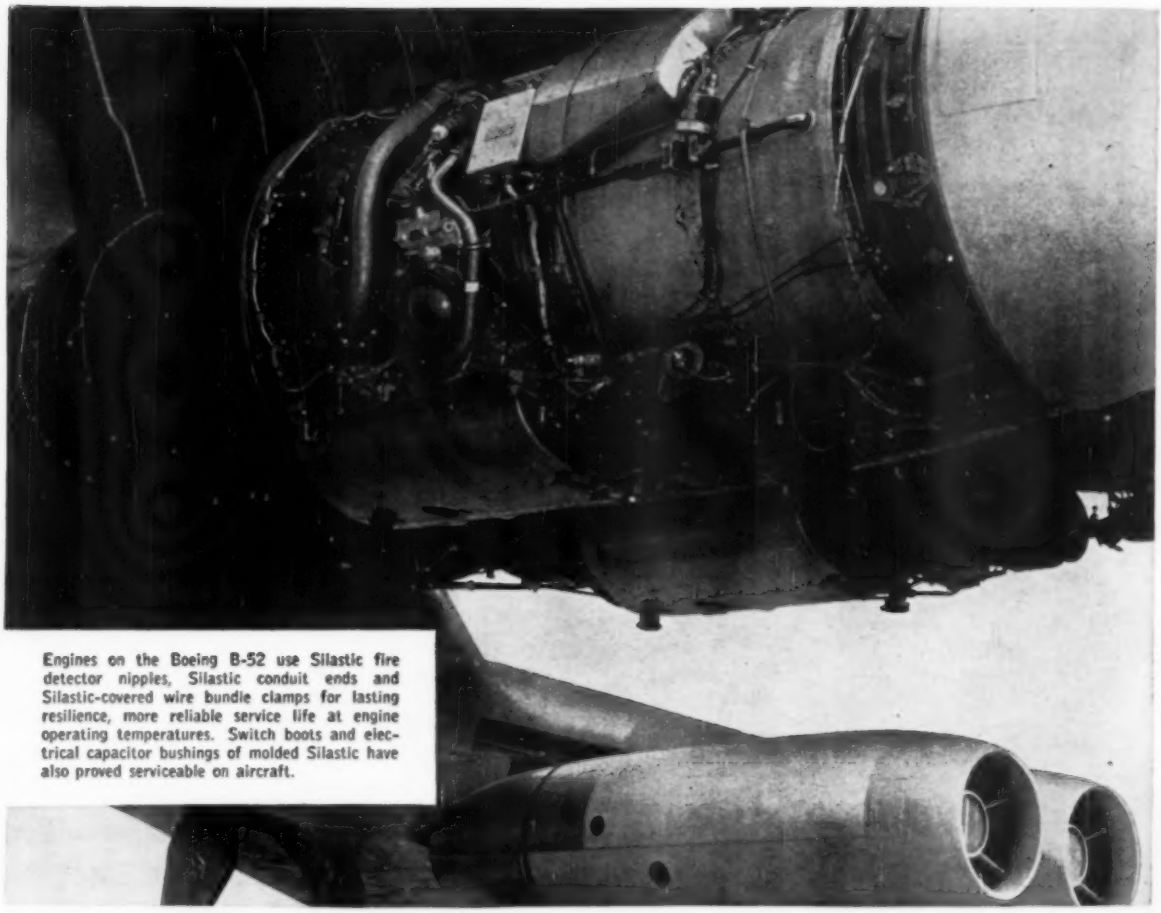
MAIN GEAR of McDonnell F-101 reflects Naval design requirements in position of lines on rear face of leg where crash barriers would not rip them off. But 150-kt. landing speed can rip tire treads; the debris wipes off lines on the rear of the leg. Lines are now being relocated to the front.

TWIN TURBOJETS of the Voodoo exhaust below the tail supporting structure. Fairing between engines and under forward part of boom is titanium structure to take the heat, blast and corrosive effects of the tailpipe and maintain strength. Note large travel of the high-mounted slab tail.



NOSE GEAR of Voodoo mounts twin landing lights, retracts forward. Note rugged structure of doors, needed to guarantee sealing under peak air loads of F-101's supersonic flight.

SHARP LIPS are characteristic of inlets for supersonic flight. F-101 duct intakes are triangular, with internal turning vane and boundary layer separator. Powerplants are paired P & W J57s.



Engines on the Boeing B-52 use Silastic fire detector nipples, Silastic conduit ends and Silastic-covered wire bundle clamps for lasting resilience, more reliable service life at engine operating temperatures. Switch boots and electrical capacitor bushings of molded Silastic have also proved serviceable on aircraft.

SILASTIC
SILICONE RUBBER
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Molded parts of Silastic*, Dow Corning's silicone rubber, show little or no change in physical or dielectric properties after long exposure to temperature extremes which would quickly ruin organic rubber. Leading rubber companies fabricate Silastic molded parts in practically any color, size or shape.

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Typical Properties of Silastic for Molded Parts

• Temperature Range, °F	—130 to 500
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• Elongation, %	150 to 300
• Compression set, %, @ 300 F	15 to 40
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• Dielectric strength, volts/mil	400 to 500
• Oil resistance	Dependent on type of oil

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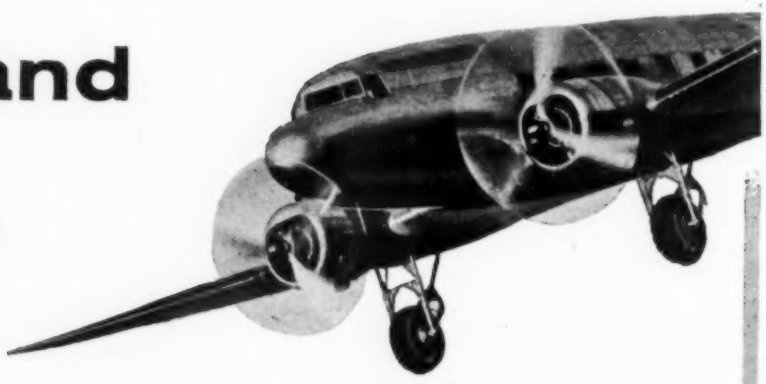

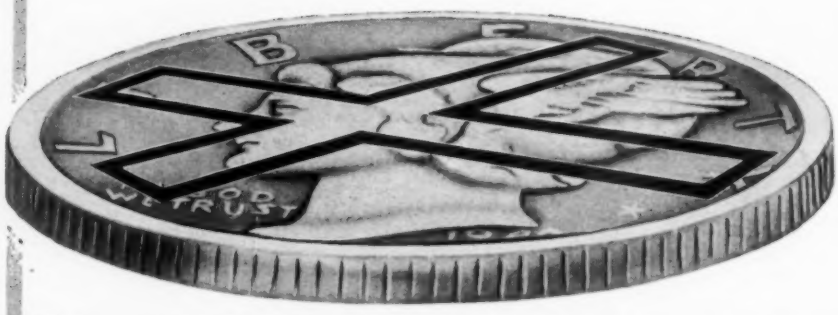

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Certificates of Necessity

Douglas Aircraft Co., of El Segundo, Calif., has been awarded a $8,170,000 certificate of necessity for accelerated tax amortization by the Office of Defense Mobilization. The certificate is for a research-and-development facility, and 80% of the total amount is allowed at the rapid rate.

Other certificates for the period May 31 to June 13 are:

Bendix Aviation Corp., Research Laboratories Div., Oakland County, Mich., research and development in military electronics, $2 million certified with 40% allowed.

Hughes Aircraft Co., Culver City, Calif., military electronic equipment, $683,637 certified with 65% allowed.

United States Time Corp., Irvington-on-Hudson, N. Y., research and development, $202,500 certified with 55% allowed; Middlebury, Conn., scientific instruments, $134,229 certified with 65% allowed; Little Rock, Ark., scientific instruments, $204,531 certified with 65% allowed.

Mepco, Inc., Morristown, N. J., electronic instruments, $245,000 certified with 45% allowed.

Microwave Associates, Burlington, Mass., electronic equipment, $493,250 certified with 45% allowed.

General Dynamics Corp., Convair Div., San Diego, Calif., research and development, $1,813,184 certified with 65% allowed; research and development, $3,500,000 certified with 80% allowed.

Elcon Manufacturing Co., Los Angeles, Calif., aircraft parts, $22,000 certified with 45% allowed.

Kearfott Co., Inc., Little Falls, N. J., precision scientific instruments, $94,459 certified with 65% allowed.

Hazeltine Electronics Corp., Little Neck, N. Y., military electronic systems, $500,000 certified with 40% allowed.

Bell Aircraft Corp., Wheatfield, N. Y., military aircraft, $153,388 certified with 65% allowed.

Fairchild Guided Missiles Div., Wyandanch, N. Y., military electronic systems, $137,061 certified with 65% allowed.

American Bosch Arma Corp., Garden City, N. Y., research and development, $879,471 certified with 60% allowed.

Bendix Aviation, Pacific Div., North Hollywood, Calif., military electronic equipment, $130,074 certified with 65% allowed.

Western Electric Co., Winston-Salem,

Capital Issues Debentures

Washington—A $12 million issue of Capital Airlines 4.25% convertible subordinated debentures due July 1, 1976 is being offered at 101.50 by an underwriting group headed by Lehman Brothers. The debentures are convertible into common stock at $33.33 per share.

Capital plans to use the proceeds to pay in full outstanding bank loans amounting to $2 million. The balance will be applied to working capital for use in the company's route expansion program. Stockholders last week voted an increase of 1,500,000 shares of authorized common stock enabling the airline to begin the financial program.

Lockheed Missile Plant

Architects drawing of Lockheed Missile Systems Division's new Sunnyvale, Calif., plant. Facility will consist of 250,000 sq. ft. Original plan was to build a 96,000 sq. ft. manufacturing building (upper right), but the project was enlarged to include a similar building for engineering (right front), administration building (left front) and cafeteria (upper left). Plans are for the plant to be occupied by next summer.

N. C., military electronic equipment, $219,-301 certified with 65% allowed.

Bendix Aviation, Scintilla Div., Sidney, N. Y., military aircraft parts, $241,025 certified with 65% allowed.

American Machine & Foundry Co., Electronics Div., Boston, Mass., military electronic equipment, $33,177 certified with 65% allowed.

Glen L. Martin Co., Baltimore, Md., military aircraft, $516,427 certified with 60% allowed.

American Welding & Mfg. Co., Warren, Ohio, military aircraft engine parts, $136,-190 certified with 70% allowed.

Hydraulic Research & Mfg. Co., Burbank, Calif., military aircraft parts, $17,197 certified with 70% allowed.

Axelson Mfg. Co., Div. of U. S. Industries, Inc., Montebello, Calif., military aircraft parts, $852,405 certified with 40% allowed.

C. B. Knapp & Sons, Maplewood, N. J., military aircraft instrument components, $36,396 certified with 70% allowed.

Ryan Aeronautical Co., San Diego, Calif., military aircraft, $170,000 certified with 65% allowed.

Fairchild Engine & Airplane Corp., Stratos Div., Bay Shore, N. Y., military aircraft components, $44,462 certified with 65% allowed.

Curtiss-Wright Corp., Propeller Div., Caldwell Township, N. J., military aircraft parts, $33,492 certified with 65% allowed.

Aircraft Engineering Products, Inc., Clifton, N. J., military aircraft parts, $34,-341 certified with 70% allowed.

Cornelius Co., Minneapolis 21, Minn., military aircraft equipment, $19,471 certified with 70% allowed.

Thomas A. Edison, Inc., West Orange, N. J., scientific instruments, $31,431 certified with 65% allowed.

Boeing Splits Shares, Adds Stock Dividend

Seattle—Two-for-one stock split approved last week by Boeing Airplane Co. directors is matched with a change in dividend policy. The package is designed to permit a greater accumulation of capital funds needed, among other things, to finance an expansion program in which it is estimated $90 million will be spent by Dec. 31, 1958. Previous estimates had been around $70 million.

Boeing stock picked up almost 1½ points on the New York Stock Exchange the morning the split was announced, but brokers were not surprised by the move. It had been predicted in a Standard & Poor's report more than a week before.

The stock closed at 94¼ at the end of the week the split was announced, an increase of 4¾ points.

President William M. Allen, in announcing the board action, said that the company requires substantial additional funds resulting from changes in government contract progress payments, and to finance the 707 jet transport production program, as well as for additions to plant and equipment.

• **Boeing previously** had announced the expansion program for the Seattle area. Included are a new development center now under construction south of the main Seattle plant, and additions to the engineering, office and manufacturing facilities at Renton, Wash.

Under the new policy, Boeing will pay a quarterly cash dividend of 25 cents per share, supplemented by a small annual stock dividend.

"It is expected," Allen said, "that the cash dividends at the new rate plus the cash value of the stock dividend will exceed the amount of the cash dividend at the rate in effect for 1955 as adjusted for the stock split."

In the opinion of the directors, the split, with the new stock to be issued August 6, will broaden the market for the stock and result in an increase in stockholders.

New SPS Fasteners Have 220,000 Psi Tensile Strength, Up to 90% Increase in Fatigue Strength*

EWB-22 Bolt is Entirely New. External wrenching head with increased bearing area permits great preloading without indentation of bolted surface. New thread form, generous fillet under head, smooth overall surface increase tensile strength and fatigue resistance.

Hi Psi units . . . results of advanced concepts in thread design and preloading techniques . . . add strength, security and weight saving to aircraft structures

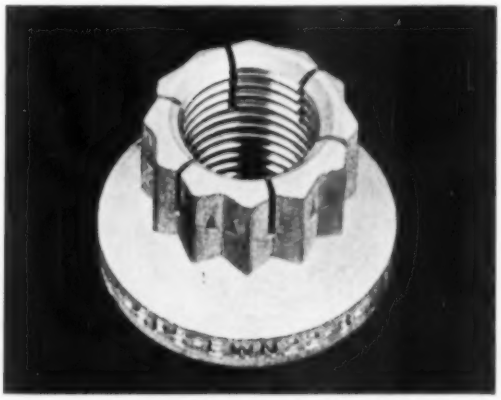
Conventional bolts were not strong enough to fasten jet-age aircraft now on drawing boards. So Standard Pressed Steel Co. discarded obsolescent fastener conformations, materials and production techniques and designed a new high strength bolt—the Hi Psi EWB-22—which has greater tensile and fatigue strength than ever believed possible.

But it is impossible to get the full benefit of the strength of any bolt unless it is preloaded accurately. PLI washers, simple mechanical devices for preloading, insure that every Hi Psi bolt installed in an airframe will carry its full share of the load.

Conventional nuts were not strong enough to develop the full strength of the EWB-22. So SPS produced the EWN-22 locknut to complement the bolt. It is a high tensile strength self-locking nut with a 12-point external wrenching surface which makes possible the high wrenching torque necessary to seat the EWB-22 securely.

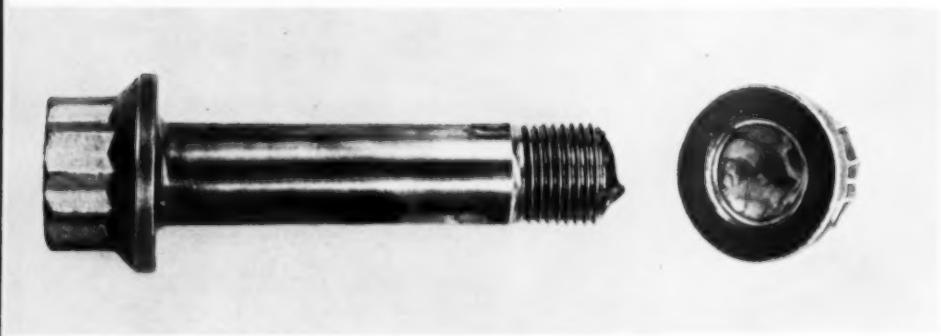
**Compared with standard 160,000 psi bolts, at 8,000,000 cycles.*

PLI-22 Preload Indicating Washers are used with the EWB-22 to induce correct preload in the bolt. They provide the most precise known method for preloading bolts during production assembly operations. They are sandwiched between close tolerance hardened steel washers.



EWN-22 Locknut was designed to develop the full strength of the EWB-22 bolt. One-piece, all-metal nut has increased bearing surface, is specially heat treated for maximum tensile strength, has 12-point external wrenching surface for high wrenching torque.

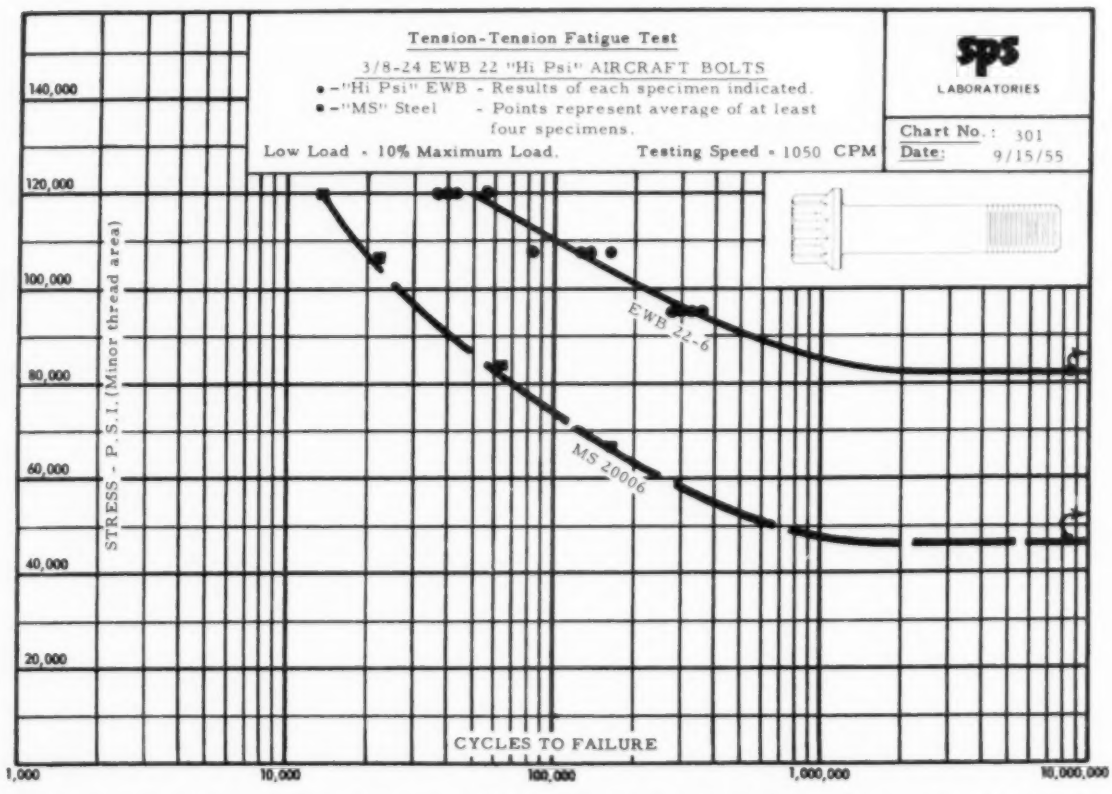
New Hi-R Thread Form is Key to Great Fatigue Resistance



EWB-22 Bolt Stressed to Destruction in SPS fatigue testing laboratory. Typical fracture occurred in vicinity of nut bearing face.

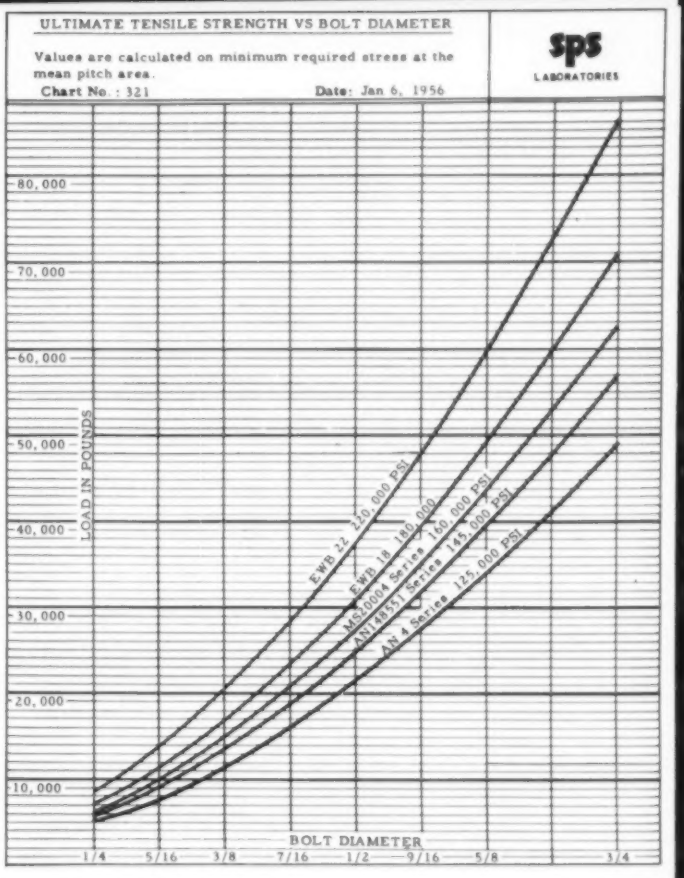
The EWB-22 has 38% greater tensile strength and up to 90% greater fatigue strength than its strongest standard counterpart, the MS bolt. The high strength of the bolt is due partly to the new alloy steel of which it is manufactured, partly to the generous fillet under the head, and partly to the fact that the threads are cold rolled *after* the blank has been heat treated and ground smooth to remove all surface imperfections and decarburized metal.

But the chief factor in the great fatigue resistance of the EWB-22 is the new Hi-R thread form developed at SPS. Normally, the thinnest—and hence weakest—part of a bolt is the minor diameter of its threaded section. The Hi-R thread form increases this dimension by 1.5 to 3.2% (depending upon bolt size). In addition, the thread root radius has been increased. This root radius is not a "worn tool arc," but a smooth uniform curve which fairs smoothly to the thread flanks, at the point of 75% thread depth, with an uninterrupted surface. (Existing gages, designed for 83⅓% thread engagement, must be opened to accommodate the EWB-22. However, the thread will assemble readily with standard nuts, since the basis of the thread design is the 60° American National Thread profile.) The uniform radius reduces stress concentration factors, increasing fatigue resistance to a maximum.



Typical Stress-Cycle Curve, comparing performance of EWB-22 with that of MS tension bolt of equal size. The EWB-22 showed up to 90% greater fatigue strength than the MS bolt.

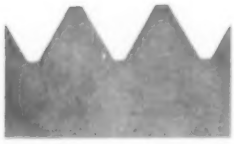
Ultimate Tensile Strength Curves. Chart shows actual strength in pounds plotted against bolt diameter. Great strength in EWB-22 derives from SPS material selection, forming, and heat treating techniques.



MECHANICAL PROPERTIES

	⅜-24 Diameter		½-20 Diameter	
	MS20006	EWB 22-6	MS20008	EWB 22-8
Tensile strength—psi				
Root thread area	192,800	281,000	199,900	266,600
Mean thread area	178,100	260,300	186,000	248,100
Pitch thread area	164,000	239,750	172,900	230,600
Bolt gage specimen*	170,000	237,200	174,400	235,200
Yield strength—psi				
Root thread area	155,750	229,900	171,600	217,000
Mean thread area	143,840	212,300	159,700	201,900
Pitch thread area	132,500	195,600	148,400	188,700
Bolt gage specimen*	148,000	202,000	158,700	211,000
Elongation—% in 4 dia.				
Bolt gage specimen*	14.5	12.5	15.6	13.5
Reduction in area—%				
Bolt gage specimen*	52.4	51.2	56.6	49.3
Shear strength—psi				
Bolt body	100,200	138,250	106,200	137,500
Fatigue strength—pounds at 8,000,000 cycles				
10% preload	3,500	6,750	7,850	11,180

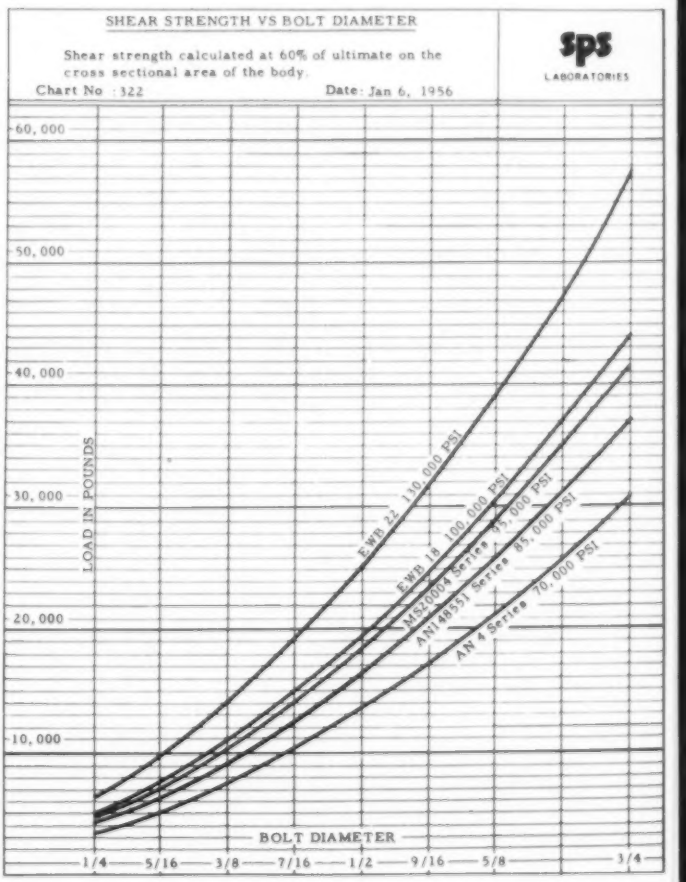
*Bolt gage specimens are gage specimens made from the bolts being tested. The gage diameter on the ⅜ inch was .252 inch and on the ½ inch was .357 inch.



Unretouched Comparator Photograph of MIL-S-7742 thread. Flat thread roots with small radii cause points of high stress concentration which reduce fatigue life.

MIL-S-7742, MIL-B-7838a Threads. Larger (.0065 in.), more uniform radius reduces stress concentration, increases fatigue life.

Hi-R Thread Form. Increased root radius (.009 in.) reduces stress concentrations still further for greater increase in fatigue resistance. Thread assembles with standard tapped holes and nuts.



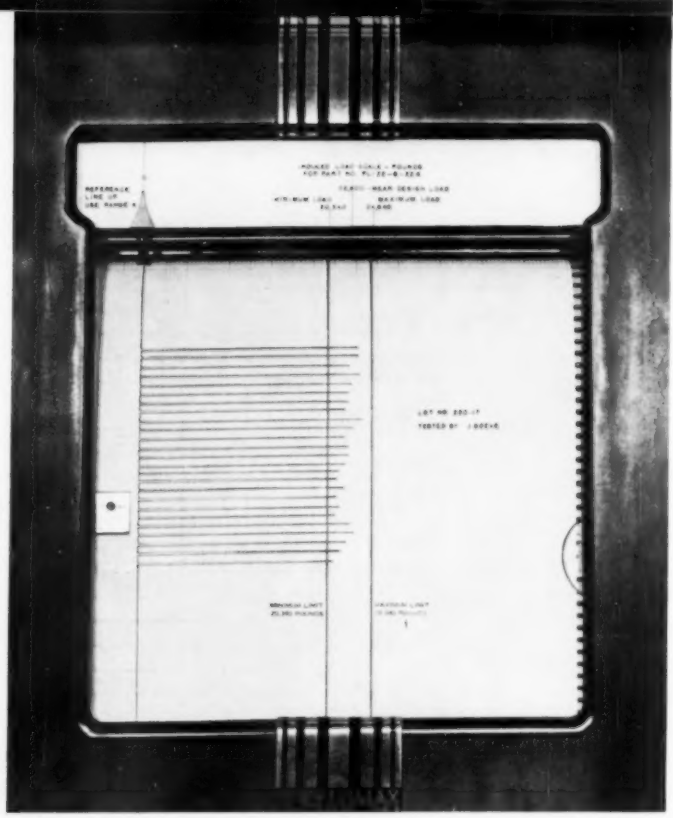
Shear Strength Curves, plotted at 60% of the ultimate, based on body cross section area. Second strongest bolt is EWB-18, also developed by SPS.

New EWN-22 Nut . . .
Preloaded with PLI Washers . . .
Develops Full Strength of Bolt

The EWN-22 self-locking nut equals the EWB-22 bolt in fatigue strength. The load is distributed over more metal threads than in conventional fasteners. And increased dimensions—in thickness of base and washer face, and area of bearing surface—help reduce stress concentrations to a minimum.

Assembling Hi Psi-22 fasteners is a simple operation. The nut is tightened down until the outer PLI ring can no longer be rotated by a wire inserted in a feeler hole. No complex electronic equipment, no unreliable torque wrench readings. Only strain gage or extensometer measurements—not feasible in production operations—exceed PLI washers in accuracy.

Detailed information on Hi Psi fasteners will be gladly sent on request. Write Aircraft Products Division, STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.



Strain Gage Measurements, electronically recorded, show that preloading with PLI washers is accurate within ±10%. Preloading by torque wrench readings varies as much as 50%.

Before Preloading. Inner PLI ring has not been compressed. Outer PLI ring can be rotated freely by wire in feeler hole. Nut is then tightened until outer ring cannot be rotated.

After Preloading. Nut has been tightened down fully. Inner PLI ring has been plastically deformed by compression. Preload in bolt equals force required to deform inner ring.

STANDARD PRESSED STEEL CO.

AIRCRAFT PRODUCTS DIVISION

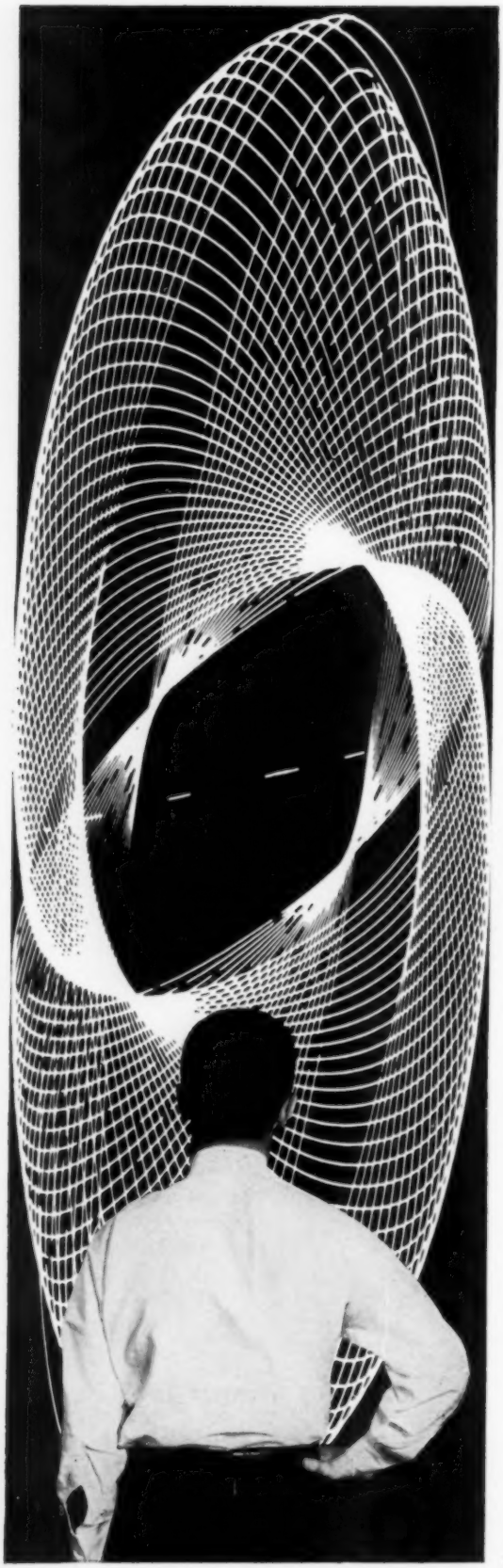
SPS

JENKINTOWN PENNSYLVANIA

Printed in U.S.A.

Tiger Tail Lengthened

Tail pipe of the Grumman F-11F-1 has been extended on the latest models (above). Aircraft normally does not rest on tail skid. Here main wheels are resting on ground lower than taxi-way on which front wheel is parked, and bringing tail skid onto ground. Padded boots (right and below) protect wheel-well doors from damage during ground handling. Perfect closures are necessary to prevent disruption of airflow on this supersonic Navy fighter. Small fin attached to fuselage under horizontal stabilizer is the "overboard fuel vent boom." Pressure fueling receptacle is located in wheel well. Small number after Navy serial number on fuselage is unofficial designation noting incorporation of improvements. Number is now being changed to a Navy lettering system.



as an Autonetics Engineer... you can achieve science-fact far stranger than science-fiction

Today at AUTONETICS there are elaborate automatic control systems actually being developed, designed and *produced* in quantity that make the mechanics of the wildest space fantasies look ordinary.

For example, where in the pages of science-fiction is there a robot that compares with AUTONETICS' new airborne digital computer? This 3-cubic-foot brain can solve mathematical problems in one second that would take a math whiz with pencil and paper 9 hours, or require a clothes closet full of ordinary computer equipment. It can continuously integrate 93 quantities simultaneously... through 51 removable panels of etched, transistorized circuitry.

This is only one example of AUTONETICS' far-reaching electro-mechanical technology. There are hundreds of other areas of equally advanced opportunity in missile guidance, flight control, fire control and special automatic controls. Among your tools are the latest data processing equipment, plus modern and complete environmental and flight test facilities. AUTONETICS' scientific leadership is setting the pace in this field with its unique 10-year backlog of know-how.

OPPORTUNITIES FOR:

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Computer Application Engineers
Automatic Controls Engineers
Electronic Engineering Writers
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Preliminary Analysis and Design Engineers
Also Openings for Draftsmen and Technicians

CONTACT: Mr. R. C. Smith, AUTONETICS Engineering Personnel Office, Dept. 991-20AW, P.O. Box AN, Bellflower, California

Autonetics

A DIVISION OF NORTH AMERICAN AVIATION, INC.

AUTOMATIC CONTROLS MAN HAS NEVER BUILT BEFORE

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

BUREAU OF AERONAUTICS, Washington 25, D. C.

The Emerson Electric Mfg. Co., 8100 Florissant Ave., St. Louis 21, Mo., modification kits, turret, 11D-2 NOas 56-347-r-(PD-43-1366-56), 221, $2,254,671.

Webster-Chicago Corp., 816 N. Kedzie Ave., Chicago 51, Ill., ARA-25 antennae, amplifiers, relays, mountings, NOas 56-401-f (PD-36-740-56 & Change A), 3149, $1,490,-071.

Westinghouse Electric Corp., Kansas City, Mo., perform work necessary to disconnect, remove, pack, crate and preserve machine tools and capital equipment at Government-Owned plants used by the contractor, NOas 56-642-c (IP-31-6033-56), job orders, $50,-000.

Armour Research Foundation of Illinois Institute of Technology, 10 West 35th Street, Chicago 16, Ill., conduct a study of cobalt-base alloys, determining the effects of melting practice, impurities and alloy additions, NOas 56-103-c (AE-41-1832-56), $30000.

Bendix Aviation Corp. (Eclipse-Pioneer Div.) Teterboro, N. J., indicator, gyro horizon, 1308-1, NOas 56-291-f (PD-42-1273-56 & changes A & B), 1636, $847448.

Collins Radio Co., Cedar Rapids, Iowa, conduct a preliminary study of methods for increasing the number of TACAN channels, NOas 56-372-d (EL-64-2719-56 & chg. A), $29929.

Irving Air Chute Co., Inc., 1315 Versailles Road, Lexington, Ky., barometric releases Mk-5, NOas 56-514-f (MA-30-4541-56), 2000, $189860.

Bray Studios, Inc., 729 Seventh Ave., New York 19, N. Y., preparation and production of master shooting scripts with partial storyboards for motion picture training films, NOas 56-545-f (PH-5-2512-56), 6, $62464.

NAVAL AIR MATERIEL CENTER, Naval Base, Philadelphia 12, Pa., April 24.

Carbide & Carbon Chemicals Co., Div. of Union Carbide & Carbon Corp., 30 East 42nd St., New York 17, N. Y., ethylene glycol, non-corrosive, (antifreeze and cooling liquid for aircraft engines), military spec MIL-E-5559-(IFB-156-62-56), 19981 gals, $26,688.

OFFICE OF NAVAL RESEARCH SPECIAL DEVICES CENTER, Port Washington, N. Y.

Rust Industrial Co., Inc., Manchester, N. H., design, development and production of expandable weapon simulators, N61339-1, $31482.

Beech Aircraft Corp., Wichita, Kans., design development and production of T-34B aircraft animated panel trainers, N61339-8, $60126.

Burton-Rodgers Technical Training Aids, Inc., Cincinnati, Ohio, design development and production of R4Y-1 aircraft animated panel trainers, N61339-12, $98962.

AVIATION SUPPLY OFFICE, 700 Robbins Avenue, Philadelphia 11, Pa.

Aire-search Mfg. Co., Div. of Garrett Corp., Sky Harbor Airport, 402 S. 36th St., Phoenix, Ariz., thermostats (383/2150-1199/52), various, $133423.

The Instruments Corp., 4 N. Central Ave., Baltimore 2, Md., parts used for wind measuring (383/23371-27G6/3/56), various, $49370.

Chandler-Evans Div., Pratt & Whitney Co., Inc., West Hartford, Conn., bellow & housing assys. for carburetors (383/2116-8010/55, various, $32149.

North American Aviation Inc., Columbus Div., 4300 E. Fifth Ave., Columbus 16, Ohio, parts for ASA/C (383/2110-1785 A3/2/51), various, $59157.

Zep Aero. 109-116 Sheldon St., El Se-

Newest Marine Workhorse

Latest Marine HOK-1, manufactured by The Kaman Aircraft Corp., Bloomfield, Conn., features intermeshing rotor blades, three fins with large middle fin for greater stability, bulged sidedoor windows for wider visibility. Picture shows cargo skyhook operation while helicopter hovers.

BARBER COLMAN

Aircraft Controls

chosen by Northrop for remote control of tow target reel

The new Northrop tow target reel, mounted in the rear cockpit of an F-89 interceptor, is capable of pulling giant banner targets at speeds exceeding 600 miles an hour. By means of the Barber-Colman apparatus illustrated below, the pilot maintains high response, finger-tip control of reel speed.

The Northrop tow target reel, shown above, is driven by an air turbine. A Barber-Colman 3″ supply air throttle valve is positioned at a speed of 90 degrees per second, without hunting, by the Barber-Colman patented* high speed, velocity feedback, 28 volt d-c servo. Send for free technical bulletins.

The complete line of Barber-Colman aircraft controls includes: Actuators; Positioning Controls; Temperature Controls; Small Motors; Valves; Ultra-Sensitive Relays; Thermo-Sensitive Elements. Consult the Barber-Colman engineering sales office nearest you: Los Angeles; Seattle; Baltimore; New York; Montreal; Melbourne.

Barber-Colman Company

DEPT. A, 1422 ROCK STREET, ROCKFORD, ILLINOIS

AIRCRAFT CONTROLS • AUTOMATIC CONTROLS • INDUSTRIAL INSTRUMENTS • SMALL MOTORS • AIR DISTRIBUTION PRODUCTS
OVERDOORS AND OPERATORS • MOLDED PRODUCTS • METAL CUTTING TOOLS • MACHINE TOOLS • TEXTILE MACHINERY

gundo, Calif., oxygen & smoke masks (JD 383/2150-1323 (33/3-5/52), 1060 ea., $35367.

Patten Co., Inc., 1803 N. 10th Ave., Lake Worth, Fla., life rafts (IFB-383-971-56), 180 ea, $40680.

NAVY PURCHASING OFFICE, U. S. Naval Supply Activities, Brooklyn 32, N. Y.

Batavia Mills, Inc., 73 Worth St., New York, N. Y., bedspreads, cotton, N140(155) 56161B (IFB-N140-1027-56), 10320 ea. $30650.

Shawmut, Inc., 208 Canton St., Stoughton, Mass., jersey, cotton, N140(383)57151B (IFB-N140-1052-56), 18588 ea, $31216.

General Textile Mills, Inc., 450 Seventh Ave., New York 1, N. Y., helmets, flight deck cotton twill, N140(383)57093B (IFB-N140-970-56), 24588 ea, $25762.

Radar Tape Recorder

Airman (top) of 498th Fighter Interceptor Squadron about to attach magazine assembly of airborne tape recorder which plays back operation of airplane's fire control system during attack. Called NADAR, recorder is a product of North American Aviation's Autonetics Division. It translates information taken from plane's radar equipment into signals representing position of plane and target. After completion of a mission, pilot of 498th (below) observes playback during training tour at Yuma Air Force Base.

Army Contracts

FOOTE BROS. HELPS BOEING "ROLL OUT" Jet History!

Jet history was made on December 7, 1955 when the first Wichita-built B-52 Stratofortress was rolled from Boeing's Wichita plant. This giant was completed four months ahead of the original Air Force schedule . . . representing a unique achievement in planning, engineering and production.

Foote Bros. is proud to have played a part in making this accomplishment possible. The stabilizer trim mechanism, flap drive assembly, wing flap screw assemblies and angle gear boxes for this model plane are some of the many precision assemblies currently being produced by Foote Bros. to meet the complex requirements of today's near sonic, sonic and supersonic aircraft and guided missiles. They represent the very finest in engineering, manufacturing technique, quality control and reliability.

Aircraft industry leaders look first to Foote Bros. for precision gearing and geared assemblies such as control surface actuators, jet engine gears, propeller pitch control gears, canopy actuators, and accessory drive units. It will pay you, too, to see Foote Bros. first for your precision requirements.

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION

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FOOTE BROS. Duti-Rated LIFETIME GEARING

This trademark stands for the finest industrial gearing made!

T.M. Reg. U.S. Pat. Off.

Army Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Army Contracting Offices:

CORPS OF ENGINEERS, U. S. Army, Office of the District Engineer, Jacksonville, District, 575 Riverside Ave., Jacksonville, Fla.

Aetna Steel Company, P.O. Box 2029, Jacksonville, Fla., fabrication and erecting structural steel for buildings R&S, WS-315A project, AFMTC, Patrick AFB, Fla., (ENG-08-123-(NEG-56-3), job, $314,247.

Maurice H. Connell & Associates, Inc., P.O. Box 726, Riverside Sta., Miami, Fla., architect-engineer services for design of addition to central control building, complex 7 & 8 and complex 23 & 24, Patrick Aux #1 AFB, Cocoa, Fla., (Negotiated), job, $40,000.

CORPS OF ENGINEERS, Office of the District Engineer, Albuquerque District, P.O. Box 1538, Albuquerque, N. M.

Brodie Construction Co., P.O. Box 2064, Amarillo, Tex., static missile test facility, schedule B, Holloman AFB, Alamogordo, N. Mex., Contract No. DA-29-005-ENG-1694 (IFB Eng-29-005-56-76), job, $1,109,897.

Allen M. Campbell Co., General Contractors, P.O. Box 836, Tyler, Tex., static missile test facility, schedule A, Holloman AFB, Alamogordo, N. Mex., Contract No. DA-29-005-ENG-1707 (IFB Eng-29-005-56-76), job, $1,109,660.

REDSTONE ARSENAL, Huntsville, Ala.

Hayes Aircraft Corp., P. O. Box 2287, Birmingham, Ala., engineering services for designing and developing special tooling and fixtures in the field of guided missiles for the research program being prosecuted by the Army Ballistics Missile Agency, 1 job, (Purchase request No. CS 12932-56), est $75,000.

Electro-Mechanical Research, Inc., Ridgefield, Conn., 16-channel telemetry discriminator station (7 items (Purchase Request No. CS 12549-56), $39,470.

Vitro Buys Majority Interest in Thieblot

New York—Vitro Corp., which has held a minority interest in Thieblot Aircraft Co., of Bethesda, Md., will acquire majority interest in the company. Vitro will exchange 51,000 shares of authorized but unissued common stock for 204,000 shares of Thieblot stock, representing the holdings of Armand J. Thieblot, president of the firm, and others.

Thieblot Aircraft, which will become a wholly owned subsidiary of Vitro, employs about 400 persons in design and production of aircraft components and ordnance. In addition, it operates the Martinsburg, W. Va. Airport.

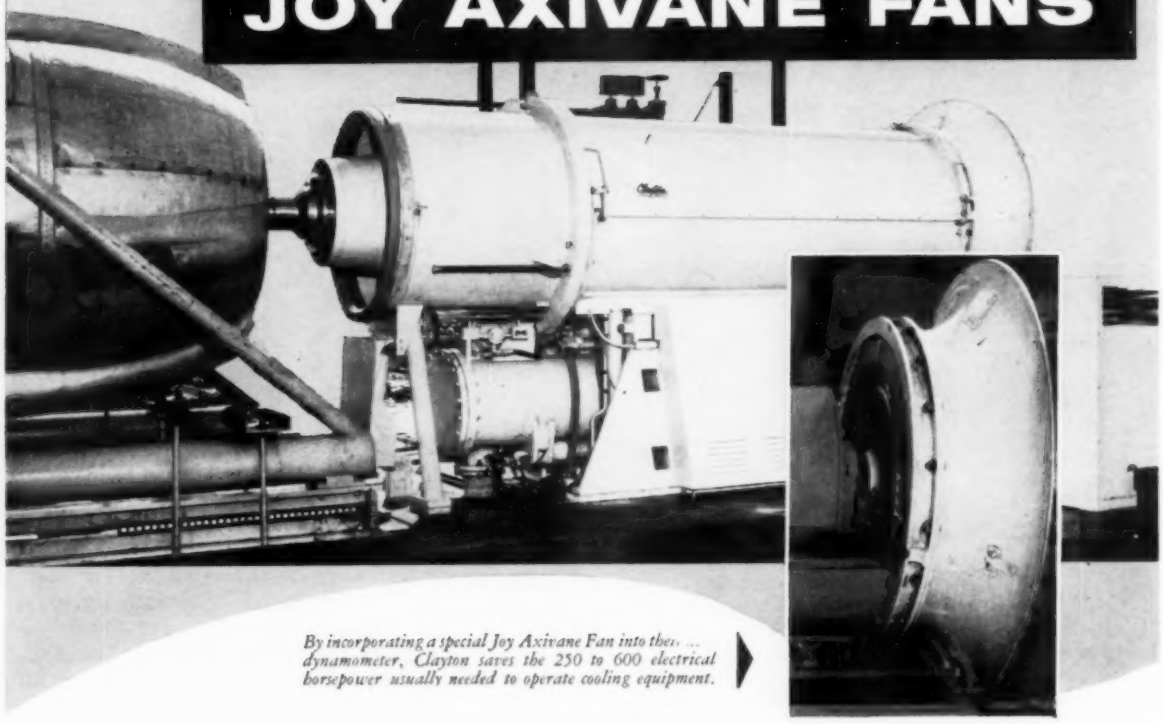
Vitro is engaged in various uranium mining ventures, weapons systems development, and in petrochemical fields.

British Air Industry Exports Show Increase

London—British air industry exports for the first five months of 1956 total $127 million, 77% higher than the same period for 1955, which was a record year. May exports totaled $23 million.

Exports to the United States—valued at $5 million—led those to all other nations for May.

New PROPELLERLESS Aircraft Engine Tester Uses JOY AXIVANE FANS



By incorporating a special Joy Axivane Fan into their ... dynamometer, Clayton saves the 250 to 600 electrical horsepower usually needed to operate cooling equipment.

Clayton Manufacturing Company, El Monte, California, utilizes a Joy Axivane Fan in their remarkable new aircraft engine dynamometer. The virtually noiseless testing device dispenses with the usual club propeller. Instead, the propeller shaft is attached to a "turbine absorber" which absorbs engine torque and measures performance.

An important integral part of the mechanism is the Joy Axivane Fan, which furnishes the air blast to cool the engine.

This fan is actually driven by the engine being tested. It eliminates the need for the 250 to 600 electrical horsepower usually required to operate auxiliary fans to cool the engine.

The Clayton Dynamometer was developed for TWA. Four will be installed in test cells in addition to the one illustrated above. In addition, each of the new test cells will be equipped with two standard, roof-ventilating Joy Axivane Fans. ● *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.* In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 108-59

ALL JOY AXIVANE AIRCRAFT FAN DESIGNS ARE BUILT TO CONFORM TO ARMY AND NAVY SPECIFICATIONS . . . WITH OVER 90 STANDARD MODELS AVAILABLE IN A LARGE RANGE OF PERFORMANCE . . . CUSTOM DESIGNS AVAILABLE ON REQUEST.

Consult a Joy Engineer

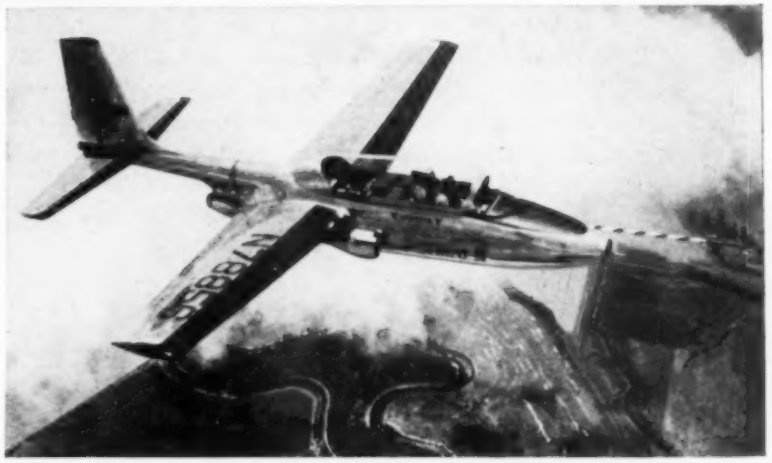
WSW 16179-108

JOY

WORLD'S LARGEST MANUFACTURER OF VANE-AXIAL FANS

Temco Jet Trainer

Model 51 primary jet trainer built by Temco Aircraft Corp. of Dallas was accepted by Navy after tests at Patuxent River, Md. Delivery in "evaluation quantity" is scheduled to start July, 1957. Airplane is powered by Continental YJ69-T-9 rated at 920 lb. thrust. Trainer has ejection seats, liquid oxygen equipment, speed brake. With maximum speed of about 300 knots, plane can land at 62 knots, take off over a 50-ft. obstacle in 3,000 ft. Model 51 has 1¼ hr. endurance at sea level, and service ceiling of 30,000 ft.



USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Offices:

OKLAHOMA CITY AIR MATERIEL AREA, Tinker Air Force Base, Okla.

Janitrol Aircraft-Automotive Division, Surface Combustion Corp., 400 Dublin Ave., Columbus, Ohio, heater assy. (RFP 337-03F-OC-646307), 7 times, $245612.

Titan Pump & Engineering Corp., 43600 Grand River Ave., Novi, Mich., gasket-fuel pump cover. (RFP 291-031-3-OC-691691), 8 items, $37361.

Fairchild Engine & Airplane Corp., Stratos Division, Bay Shore, Long Island, N. Y., overhaul of N15-1 turbine assembly. (purchase request OC-696260 & C1), job, $88470.

Northwest Steel Erection Co., 6901 Columbus Ave., S., Minneapolis 23, Minn., installation of radio point-to-point antenna farm facilities. (IFB 34-601-56-157), job, $32957.

Craig Systems, Inc., 90 Holton St., Danvers, Mass., interconnecting cable set. (RFP 446-AACS-56-09), 1 item, $45586.

Gates Rubber Co., Sales Division, Inc., 999 S. Broadway, Denver 17, Colo., hose assy. (IFB 34-601-56-313), 3 items, $25770.

Arma Division, American Arma Corp., Roosevelt Field, Garden City, Long Island, N. Y., reproducible copy and negatives for: Handbook of Operation and Service Instructions for Voltage Comparator. (purchase request 30B-OC-418208), 36 items, $913239.

Mead Mfg. Co., Inc., 239 Bernard St., Trenton 8, N. J., cushion-acft seat bottom. (IFB 34-601-56-273), 2 items, $50584.

Arma Division, American Bosch Arma Corp., Roosevelt Field, Garden City, Long Island, N. Y., technical data (30B-OC-418-208), job $913239.

Gates Rubber Co. Sales Division, Inc., 999 S. Broadway, Denver 17, Colo., hose assy. anti G suit non-eject rubber, (IFB 34-601-56-313), 3 items, $25770.

Koehler Aircraft Product Co., Inc., 409 Leo Street, Dayton 4, Ohio, valve assembly drain. (RFP 276-031-2-OC-455524), 16 items, $125546.

United Aircraft Corp., Hamilton Standard Division, East Hartford, Conn., modification of cooling turbine. (OC-734162), job, $53910.

SAN ANTONIO R&D PROCUREMENT OFFICE, Air Research and Development Command, P.O. Box 63, Lackland Air Force Base, San Antonio, Tex.

Syracuse University, Syracuse, N. Y., research to determine relationships between value and attitudes, and the roles of values in attitude change, (contract AF 41(657)-73) job, $35,919.

SACRAMENTO AIR MATERIEL AREA, McClellan Air Force Base, Calif.

Addressograph-Multigraph Corp., 1200 Babbitt Road, Cleveland 17, Ohio, duplicating machine-offset process, 12 ea., (P/R 464) $26,873.

Brad Harrison Co., 4222 Warren Ave., Hillside, Ill., cable assy, P/N 8211-7138, cable assy, P/N 8211-7156, cable assy, P/N 8211-7162, various quantities, (P/R 5267) $36,186.

GADSDEN AIR FORCE DEPOT, Gadsden Air Force Station, Gadsden, Ala.

Hart Metal Products Corp., 3333 Hammond Ave., Elkhart, Ind., box, metal, air shipment collapsible pallet style type MN-1 in accordance with Exhibit WCL-847, 2,000 ea., $152,988, (IFB-01-608-56-27)

Mirax Chemical Products Corp., 4999 Fyler Ave., St. Louis 9, Mo., drum, metal, new steel, enameled interior and exterior with removable head, in accordance with MIL-C-6054A and amendment 1 dated 30 Jan 51, size 4,7,9 and 13 gal rated capacity, 67,000 ea., $134,117, (IFB-01-608-56-30)

MIDDLETOWN AIR MATERIEL AREA, Olmsted Air Force Base, Middletown, Pa.

Mead Mfg. Co., Inc., 239 Bernard St., Trenton 8, N. J., cushion, parachute seat, 10708 ea, $4438, IFB PR MA-598704.

General Electric Co., West Lynn, Mass., repair of transmitters, 200 ea, $29600, PR MA-598811.

ROME AIR FORCE DEPOT, Griffiss Air Force Base, Rome, N. Y.

Eastman Kodak Co., 343 State St., Rochester 4, N. Y., film, 14" x 20", 80 pkg; film,

24" x 32", 280 pkg, (RFP 30-635-56-4479Q), $26658.

General Cable Corp., Railroad St., Rome, N. Y., wire-electrical MIL-C-4921, 2000000 ft, (IFB 30-635-56-186B), $382000.

Bendix Aviation Corp., Bendix Radio Division, Townson 4, Md., modication kit AN/CPN-18A, 92 ea, (RFP 30-635-56-4282Q), $3074704.

General Cable Corp., Railroad St., Rome, N. Y., cable-telephone, 407500 ft, (IFB 30-635-56-131B), $283585.

TOPEKA AIR FORCE STATION, Topeka, Kansas.

Carbide and Carbon Chemicals Co., Div. of Union Carbide and Carbon Corp., 30 East 42nd Street, New York, N. Y., methyl alcohol, 270500 gal, $78,232.

U. S. Industrial Chemicals Co., Div. of National Distillers Products Corp., 99 Park Avenue, New York, N. Y., ethyl alcohol, 49995 gal, $26344.

Eagle Chemical Co., Inc., 1501 W. Congress St., Chicago, Ill., desiccant, 5580000 bags, $60883, (IFB 14-604-56-521).

Filtrol Corp., 5250 E. Washington Blvd., Los Angeles, Calif., desiccant, 5960100 bags, $94597, (IFB 14-604-56-521).

Wright Aeronautical Div., Curtiss-Wright Corp., Wood Ridge, N. J., special tools, 2936 ea, $97681, (RFP 14-604-56-5086).

AIR FORCE MISSILE TEST CENTER, Patrick Air Force Base (ARDC), Fla.

Spar Engineering & Development, Inc., Paxson and South Aves., Wyncote, Pa., calibration test system, 1760-NIz 120251-45, (PR No. AF-16-M-IV-LP-56-20383), $33-600.

Technitrol Engineering Co., 2751 N. 4th St., Philadelphia 33, Pa., one flac high speed memory driver (PR No. FP-1(56)-299), job, $57407.

Wollensak Optical Co., 850 Hudson Ave., Rochester 21, N. Y., camera, 2900 NL 12039-75, 30 ea, (PR Nos. FP-1(56)-289, FP-1-(56)-311), $263288.

EGLIN AIR FORCE BASE, Fla.

EPSCO, Inc., 588 Commonwealth Avenue, Boston 15, Mass., converter, airborn, analog, voltage to digital, consists of a digitizer and power supply (PR 16L-56-188, IFB 08-603-56-412), 1 ea, $34700.

Fairchild Electrotechnics, Division of Fairchild Engine, 118 East 16th., Costa Mesa, Calif., bridge balance-in support of tow target and fighter mounted gun tests (PR 17C-56-1060, 1084, 1146; IFB 08-603-56-442), 4 ea, $10124.

OGDEN AIR MATERIEL AREA, Hill Air Force Base, Utah.

Douglas Aircraft Co., Inc., Santa Monica, Calif., miniature photo firing error indicator rods. Three (3) ground handling equipment technical data, $346622, (PR PH-236588).

Plaikins, Inc., 57 State St., Paterson, N. J., tow targets, MA-6, in accordance with Exhibit WCL-340, 5000 ea, (PR 00-497257 & 00-497257-1), $709100.

Link Aviation, Inc., Nolan Road, Hillcrest, Binghamton, N. Y., analytical overhaul of the C-11A & C-11B instrument flying trainer (PR-00-555309), $113403.

SHELBY AIR FORCE DEPOT, Wilkins Air Force Station, Shelby, Ohio

The Garrett Corp., AiResearch Mfg. Co., Arizona Div., 402 S. 36th St., Phoenix, Ariz. (PR 570384-1, 53457, 218940), compressor-air-gas turbine driven-trailer mounted, USAF type MA-1A, 88 ea, $1546030, compressor air-gas turbine driven-trailer mounted, USAF type MA-1A, 201 ea, $3858247, first article test units MA-1A, 2 ea, $95364, winterization kit 1AW WCE-375-B, 2 ea, $1254, maintenance data 1AW MCMTT Exhibit 1-10, $57665, engineering data, $500, packaging, 217 ea (domestic), $33352, packaging (export), 74 ea, $28771, mock up items, $8500, compressor-air-gas turbine driven-trailer mounted, 2 ea, $35988, total, $5665674.

Mario Papa & Sons Inc., 121 S. Main St., Gloversville, N. Y., glove, leather; work type. Men's gauntlet cuff; brown, USAF, type B3A restricted usage, for flying personnel only. Spec MIL-G-9087A, 34000 pr, $80359, (IFB 33-602-57-97 B).

ICAO Issues Manual For Air, Ground Training

Montreal—International Civil Aviation Organization has issued an air and ground crew training manual "designed to encourage a high standard of professional training and competence and to give a sense of continuity and common international effort to aviation training centers all over the world."

The manual, described as a guide for aviation authorities and technical training school operators rather than a textbook, was produced by the secretariat of ICAO in collaboration with aviation training experts from various countries among the 68 represented in the organization's membership. Sections of the manual presently available in English, French and Spanish deal with commercial pilot training, use of aviation training films, ICAO's synthetic traffic control-communications trainer, radio operation, radio mechanics, air traffic control and airport fire service personnel.

Beech Will Build More Components for F-101A

Additional Military contracts for Beech Aircraft Corp. include a second follow-on work order for McDonnell F-101A Voodoo jet fighter components totalling about $7,750,000, extending the project until March 1958, and a $5,307,000 contract from USAF for MA-3 mobile multi-purpose ground power units for aircraft.

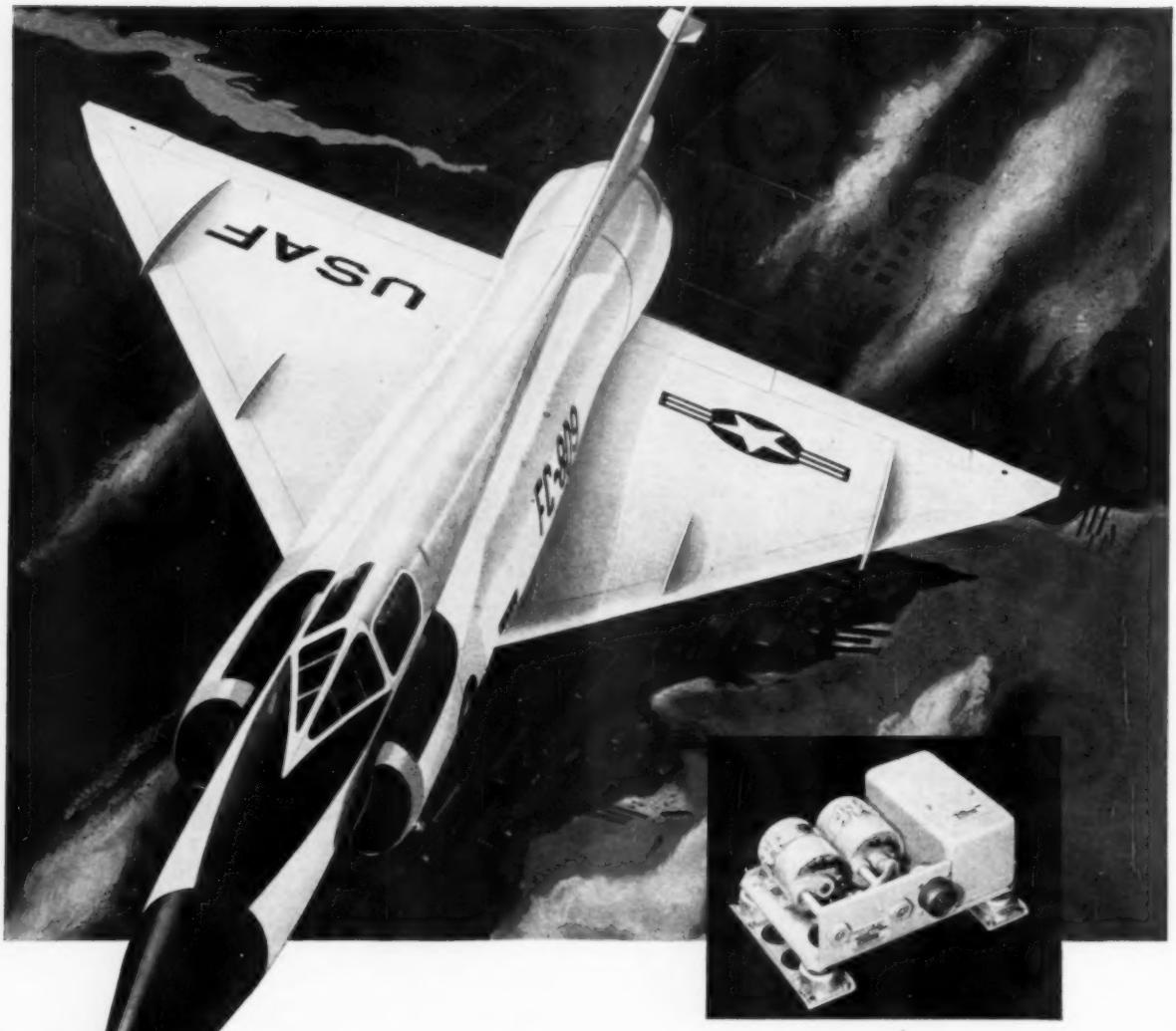
Edo Stock Goes on Market Ending Closed Operation

After 31 years of operation as a closed corporation, the Edo Corp., College Point, N. Y., has put its class A stock on sale to the public. The stock is listed on the American Stock Exchange and was selling from $8.50-9 a share. A 15-cent dividend was declared last month.

Edo, founded in 1925 to manufacture seaplane floats, has since expanded in the hydro-dynamics field, and into the electronics field.

Machine Tools, Equipment Will Be Sold at Offutt

Several hundred machine tools and items of industrial equipment will be sold by the Tumpane Co., Offutt AFB, Neb., on a sealed bid basis beginning in September. Requests for invitations to bid should be addressed to the company. The equipment is in storage at the Air Force Departmental Industrial Equipment Reserve Storage Site No. 1 at Offutt.



The Interceptor champion has a midget manager

Giannini Trim-servo System specified for Convair F-102A... wide range...high altitude...sensitive

The development of Century Series Aircraft has greatly intensified the need for Giannini precision instruments and systems to simplify the increasing complexities of high speed, high altitude flight. An outstanding example is the Giannini functional Mach computer for the elevon trim-servo system which enables the Convair F-102A all-weather interceptor to maintain subsonic trim characteristics at supersonic speeds.

The trim-servo system, a highly accurate Mach number and altitude sensing-computing system which reacts to speed changes as small as 0.0005 Mach, is one version of the servoed bridge network computing systems previously designed and developed by Giannini avionic engineers. The basic design has such capability and flexibility that a prototype computing system was produced for Convair in less than three weeks. Delivery of the first production model was made in less than two weeks from date of purchase order.

This rapid design and development is one more instance of Giannini's superior performance in the engineering and production of quality airborne equipment.

Engineering positions are open at several Giannini locations for career-minded young men—write for details.

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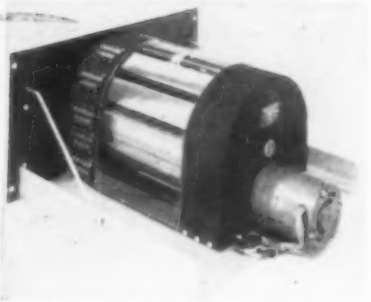

RELAY OPERATORS (left) who transmit Volscan flight path instructions may soon be replaced by automatic voice relay. Voice recordings of key word-groups stored on magnetic drum (above), are automatically pieced together according to Volscan signals to form complete voice commands which are then transmitted over UHF/VHF radio channels.

Priorities Built In Automatic Voice Relay

By Philip J. Klass

An automatic voice relay (AVR) which converts Volscan (return-to-base computer) flight path steering signals into human voice radio commands, giving priority to urgent messages, has been developed by Cook Research Laboratories, Skokie, Ill., under USAF sponsorship.

A less sophisticated version of the automatic voice relay could eliminate language difficulties for international carriers by enabling mono-lingual traffic controllers to give instructions in a variety of languages.

Evaluated this Fall

The AVR was developed for Air Force Cambridge Research Center's Navigation Laboratory and will be evaluated with a new prototype Volscan unit this fall. Navigation Laboratory Chief Ben Greene reports that the Air Navigation Development Board has expressed an interest in a semi-automatic voice relay to evaluate its civil applications.

Heart of the AVR is a magnetic drum upon which are stored human voice recordings of 81 key word-groups. These are automatically selected and pieced together by Volscan signals almost instanteously to make a complete voice command.

In a semi-automatic version for multi-lingual use, key word-groups would be recorded in several languages. A traffic controller would select the language in which he wished to transmit his instructions, then select the desired message by actuating buttons on a keyboard identified in the controller's native language.

Volscan computed flight path steering instructions presently are displayed on consoles to four human relay operators who must convert what they see into voice radio instructions to each airplane under control. Each relay operator normally handles three aircraft, shares a fourth with an adjoining operator, work load permitting, i.e. as when aircraft are far out and need infrequent guidance instructions.

The Cook automatic voice relay equipment will make it possible to replace the four human relay operators with a single relay monitor. The latter will be available to handle emergencies or messages which might be outside the AVR's limited vocabulary. The relay monitor will sit at a control console from which he can monitor all outgoing transmissions and receive incoming messages from aircraft.

Message Priority

One of the most unusual features of the Cook AVR is its ability to give priority automatically to more urgent messages. The prototype has 15 channels, one more than the number of Volscan channels. These 15 are divided into three groups of five, each group having a single radio frequency channel. Thus five aircraft share a single frequency for Volscan instructions.

Because individual Volscan computer channels come up with new instructions in random fashion, the AVR must determine and assign an order of priority for transmission of the five channels assigned to each frequency. It does this both on the basis of message content (how large a change of heading is required), and how far out the airplane is in its approach. The airplane nearest the final approach gate is given highest priority. The AVR transmits a new heading to an aircraft only when Volscan calls for a heading change of 5 deg. or more.

Three selector units, one for each transmission channel, accept the random Volscan output signals, determine the highest priority signal, then assemble the required message from the recorded word-groups on the magnetic drum.

AVR Vocabulary

To simplify the vocabulary of word-groups, which must be stored on the drum, individual aircraft entering the Volscan control area will be assigned code identifications as "Red Three," or "White Five." Automatic voice relay instructions will be addressed to them using the assigned code identification.

The recording of word-groups as "two hundred sixty-five degrees" instead of recording the individual words, "two," "hundred," "sixty," etc., requires more drum capacity. However, it greatly increases the intelligibility of the AVR voice because the phrasing is more natural than if the individual words were extracted and pieced together, explained Tom Dunsheath, AVR project engineer.

Several Advantages

In addition to eliminating three of the four human relay operators now required for Volscan, the new auto-

HOW A TINY NEW TUBE HELPS SAVE LIVES

The problem was major: it concerned human life. A pocket-sized waterproof "radio station" would help rescue downed aviators. The set was designed to send out a beacon signal and provide voice contact with search planes—but it lacked the necessary power output. Needed tubes did not exist.

Using its own resources, Raytheon developed a new subminiature tube—the 6147 and its improved version the 6397. Result: greater power, reliable operation, ranges over 50 miles, longer battery life.

Here is particularly dramatic proof of the skills which have made Raytheon the world's leading manufacturer of special purpose electron tubes.

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matic voice relay has several other significant advantages. It will:

• **Eliminate human errors** in reading Volscan indicators and converting them into vocal instructions. The AVR doesn't tire.

• **Provide standardized** message structure.

• **Improve message** intelligibility by permitting use of a recorded voice with ideal pitch and precise enunciation.

The automatic voice relay is an outgrowth of a Cambridge Research Center development for a classified project. Although the USAF expects eventually to equip its aircraft with automatic data link for transmission of Volscan and air defense information, the AVR will provide a useful back-stop for data link when that time arrives. Meanwhile the AVR has several important military applications in addition to Volscan, and it might, in semi-automatic version, prove a great boon to pilots and controllers at international airports around the world.

Expansions, Changes In Avionics Industry

Sperry-Rand will build a new $1¼ million 50,000 sq. ft. research and development facility in Salt Lake City, slated to begin operations before year end. (Sperry's action follows moves into the Rocky Mountain area by Glen L. Martin and Ramo-Wooldridge.) The new Sperry Utah Engineering Laboratory will be headed by Paul W. Vestigo, formerly in charge of Ground Armament Engineering at Sperry Gyroscope Co. Company says it will employ 300 engineers and technical personnel at new facility. Company also has formed Sperry Semiconductor Division to develop transistors. The new $500,000 laboratory is located at South Norwalk, Conn. Samuel M. Grafton is manager, and Dr. Bernard J. Rothlein technical director.

Other recent expansions and changes in the avionics industry include:

• **The Ramo-Wooldridge Corp.,** Los Angeles, has established a research, development and technical liasion activity in Boston at 1336 Soldiers Field Road. Office is headed by George E. James, former chief engineer of Laboratory for Electronics.

• **American Bosch Arma Corp.,** Garden City, N. Y., will operate 750,000 sq. ft. Government-owned factory near Chicago's Midway airport previously operated by Studebaker-Packard to build jet engine parts. Arma says plant will be used to support its expanding defense production program. Company holds contracts for B-52 armament and Atlas missile guidance.

• **Raytheon Manufacturing Co.** will build new engineering laboratory for avionics and infrared equipment near Santa Barbara, Calif. The 35,000 sq. ft. facility is expected to employ a total of 125. A small advance group is now working in temporary quarters in Santa Barbara.

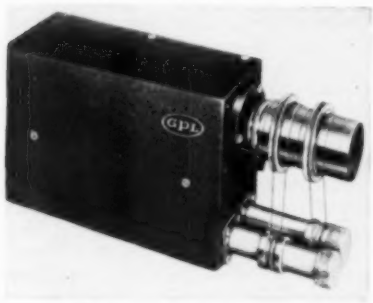
• **Marvelco Electronics Div.,** National Aircraft Corp., Burbank, Calif. has established an advanced electronic research center in San Diego, Calif., at 5063 Harbor Dr. New facility will work in telemetering, data handling and display, guidance and navigation.

• **Eitel-McCullough, Inc.,** San Bruno, Calif., has opened a new microwave tube facility at Salt Lake City to develop and produce reflex klystrons for airborne applications.

• **Damatic Corp.,** Newton Highlands, Mass., is building new 20,000 sq. ft. facility. Company, which is active in electronic data processing field, is jointly owned by Minneapolis-Honeywell and Raytheon.

• **Consolidated Electronics Industries Corp.,** New York, has purchased Technical Electronics Corp., Culver City, Calif., maker of motors, system analyzers, and packaged electronic circuits. New acquisition will manufacture timing motors produced by another division of the parent company, A. W. Haydon Div.

• **National Electronics Corp.** is new name of Morand Electronics Co., Los Angeles. Company also has purchased El Ray Motors, Inc., North Hollywood, maker of fractional horsepower motors.



Rugged Camera

New ruggedized TV camera, Model PD-152, designed for airborne or closed-circuit use, has operated successfully despite 15G's applied in each of three axes. Unit can be operated up to 70,000 ft. altitude. Lens opening and focus can be adjusted by remote control. Camera weighs 6 lb., measures 3 x 5 x 9 in., employs 525 line system, 60 fields interlaced, with 550 line resolution. Manufacturer: General Precision Laboratory, Pleasantville, N. Y.

FILTER CENTER

▶ **Come and Get It**—New high-power airborne radar beacon for airborne tankers, developed by Sperry Gyroscope Co., makes it possible for fuel-hungry USAF aircraft to spot the tanker under all-weather conditions. Developed under Wright Air Development Center sponsorship, the new APN-69 beacon is being produced both by Sperry and Stromberg-Carlson.

▶ **Any Objections?**—Greater use of women in engineering and the physical sciences to ease the critical shortage in these fields has been urged by Dr. Charles B. Jolliffe, vice president and technical director of Radio Corp. of America. Noting that 20% of the engineers in Russia are women, compared to less than 1% in the U.S., Jolliffe calls for efforts to interest high school girls in science.

▶ **Canadian Decca**—Bendix-Pacific has obtained Canadian rights to manufacture and sell the Bendix-Decca navigator system. Canadian Air Force and Army recently conducted tests on Decca and the Canadian Hydrographic Office has adopted it primarily for use along the country's east coast.

▶ **ADF Spec Issued**—Aeronautical Radio Inc. has issued a new airborne direction finder characteristic, No. 530A, prepared by its Airlines Electronic Engineering Committee. Copies are available to interested manufacturers. Arinc's address: 1700 "K" St. N. W., Washington, D. C.

▶ **New Transponder Source**—Stewart-Warner is entering the airline avionics market with an air traffic control transponder, designed to Arinc specs (No. 532A).

▶ **Lowest ILS-Coupler Limit**—Series 700 Viscounts fitted with Smiths S.E.P.2 autopilot and approach coupler have been authorized by the British Air Registration Board to make automatic ILS approaches down to within 200 feet of the runway in calm or turbulent conditions. Smiths says this new break-off height limit is the lowest approved by any civil authority.

▶ **NEC Date Set**—National Electronics Conference will be held in Chicago, Oct. 1-3. Theme: "Fifty Years of Progress Through Electronics." Conference is sponsored by American Institute of Electrical Engineers, Institute of Radio Engineers, Illinois Institute of Technology, Illinois and Northwestern Universities.

Cessna T-37 designed for Jet Training

To meet jet age demands, the U. S. Air Force requires a jet trainer that makes it easy for cadet-pilots to master first-line combat airplanes.

The Cessna-developed T-37 introduces the cadet to all combat jet airplane characteristics while training on this safe, easy-to-fly jet trainer.

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It is a privilege for us here at Cessna to team with the Air Force in its forward-thinking plans for the jet age. CESSNA AIRCRAFT COMPANY, Wichita, Kans.

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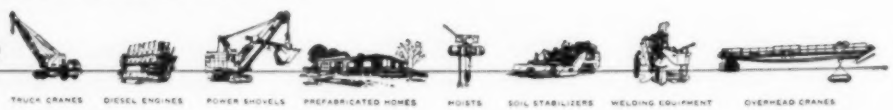

P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING COMPANY LTD., 455 King Street West • Toronto, Ontario, Canada

Rubber Bags in DC-3 Carry Bulk Oil

By Alicja Grobtuck

Melbourne—New method of transporting bulk supplies of petroleum products by air was evolved in Australia to keep petroleum product prices at reasonable level in the outback areas of New Guinea.

Synthetic rubber bags of special design, replacing steel drums, will be securely placed inside Douglas DC-3s belonging to Mandated Airlines Ltd. They will be initially used in supplying the isolated Goroka area in the central highlands of New Guinea. The operation will be the first commercial venture of its kind in the world. The idea was initiated by aviation officers and engineers of Vacuum Oil Co. at Melbourne, Australia.

Year's Work

The development of the scheme has taken a year. The synthetic (Hycar) rubber bags were specially made by the Aviation Division of Dunlop Rubber (Australia) Ltd. They are built to withstand working conditions at 100F at an altitude of 20,000 ft. Webbing withstands stress of 2,800 lb. Modifications to the aircraft were worked out by the Engineering Research Division of Australian National Airways, Ltd.

Gasoline and other refined petroleum products, including aviation gasoline, are pumped from underground tanks into the modified aircraft fitted with four rubber bags of 200 Imperial gal. each. Self-sealed and vented, the bags occupy all the aircraft's cargo floor space. On arrival at the Goroka airstrip (120 mi. distance and over 5,000 ft. above sea level) the contents are emptied by pumping or gravitation into Vacuum's underground storage tanks.

Folded for Return

Empty bags are folded to a minimum size and stowed in the aircraft for return trip. This provides maximum space in the aircraft for loading of cargo for return trip to Lae. Previously this was not practicable because of the bulk of the empty drums.

The new method will ensure continuity of supplies of petroleum products to one of the most isolated areas in the world. Later on the method will be applied in Western Australia and to other inaccessible points in central and north Australia.

The reduction of double handling of heavy steel drums and considerable decrease of freight costs are noted.

FULL SIZE Hycar synthetic rubber container in crash position. Webbing and holding down points are built to withstand 6 G strain with 2,000 lb. of water in container.

VENTING SYSTEM on 200 Imp. gal. synthetic rubber bag is about to be tested at plant of Dunlop Rubber Co., Melbourne. Bag withstands 100F at 20,000 ft.

The art of rocketry

The portraits of tomorrow's propulsion systems are rapidly becoming realities at Aerojet-General. America's foremost manufacturer of rocket powerplants, Aerojet is a major contributor to this nation's most critical rocket and missile programs.

But creation takes talent.

Operations at Aerojet's California plants, near Los Angeles and Sacramento, are expanding rapidly. Unparalleled career opportunities exist for scientific and engineering personnel at all levels of experience.

Please write the Director of Personnel, Aerojet-General Corp., *Box 296, Azusa, Calif.* or *Box 1947, Sacramento, Calif.*

Your resume will receive immediate, confidential attention.

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Controlled Runway Light

Bi-directional beams of HRC-type runway light can be aimed or brightened by remote control to meet varying weather conditions. Operation is by means of a control panel in the airport tower.

Units have a double-prismatic lens system having a 500-w. 115-v. pre-

focused lamp. Each fixture stands 19 in. high. Operation for such a system along a runway requires a 2,400-v. circuit from a transformer vault to underground manholes, installed one per eight or nine fixtures. A runway will require 8-10 manholes.

Crouse-Hinds Co., Wolf & Seventh North Sts., Syracuse, N. Y.

Checks Superchargers

Reading frequencies in cycles per second, Stroboconn can be used to measure and check supercharger impeller revolutions, electronic units of jet engine fuel controls, flight amplifiers and in propeller balancing.

Periodic and transient phenomena can be instantaneously and directly read on the instrument.

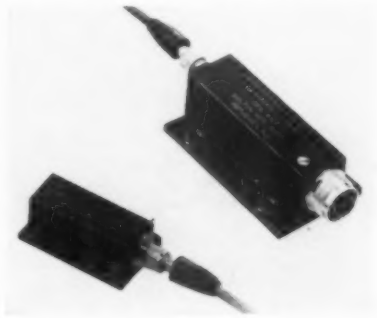
Frequency range is 32.703 to 4,186 cycles per second and range can be extended indefinitely, the manufacturer points out, using external frequency dividers, which do not affect the unit's accuracy, given as within 0.05%.

C. G. Conn, Ltd., Elkhart, Ind.

High Temperature Accelerometer

Glennite KAHT-310 accelerometer and external cathode follower unit for environmental testing will measure shock and vibration phenomena up to 300F without external cooling.

Subminiature system has a frequency response from 10-200 cps. and accelera-



tion range to 300G. Sensitivity is 20 mv/G, output impedance of 200 ohms. Accuracy is reported as 5%.

Gulton Manufacturing Corp., Metuchen, N. J.

Durable Interior Panels

High impact plastic sheets, called Plio-Tuf, being installed in the control car of Goodyear's non-rigid airship "Ranger" to provide a durable, attractive interior. Plio-Tuf is a modified styrene resin which can be cut, riveted, punched and drilled. Its maker, the Chemical Division, Goodyear Tire and Rubber Co., says that the 30 x 72 in. sheets are light, hard, tough, flexible, chemically inert and come in a variety of colors.

Small Jack Lifts Big Planes

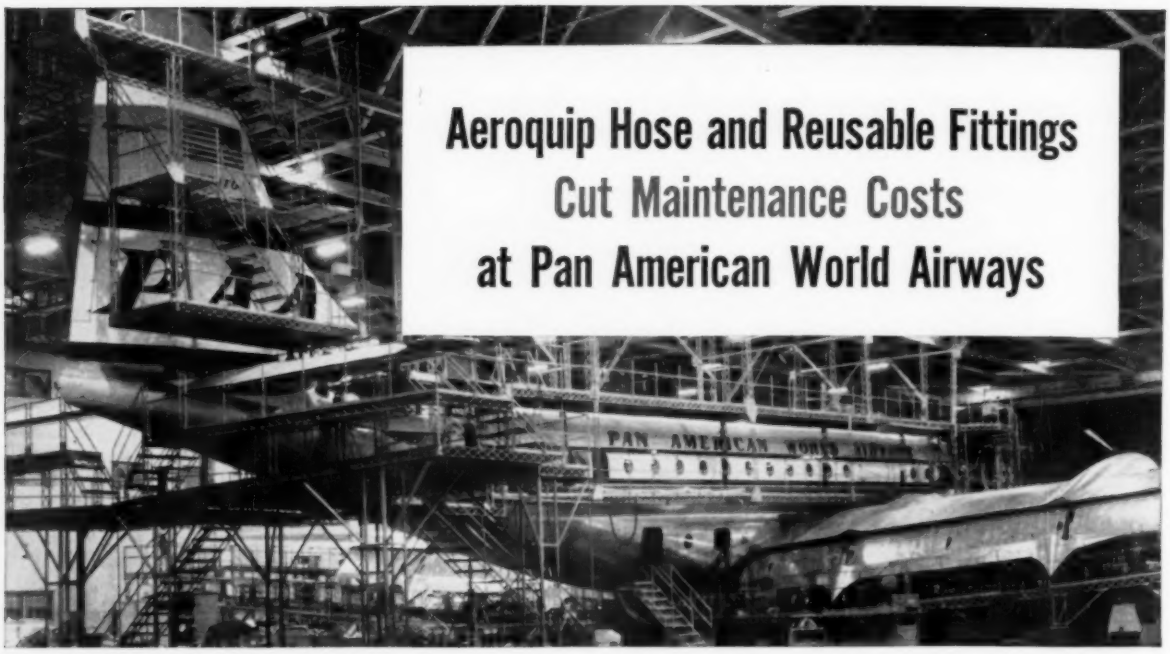
A jack that weighs under 100 lb., yet has a 17-ton hydraulic lifting capacity is now available to civilians. It was designed for the Air Force. Unit has a base of 9 in. to permit easy installation. The telescopic cylinder raises to 29 in. on actuation.

Los Angeles Automotive Works, 1020 Towne Ave., Los Angeles, Calif.

Actuator Motor for Missiles

An actuator motor that delivers 0.208 hp. at 28 v. d.c. and weighs 2.5 lb. operates an electro-magnetic brake that will stop the output shaft within 60

Aeroquip Hose and Reusable Fittings Cut Maintenance Costs at Pan American World Airways



PAA designed and built this dock to provide quick access to all parts of the giant Clipper.

Pan American's Overhaul Base in Miami, the largest commercial aviation maintenance base in the world, keeps a fleet of 100 Clippers in top flying condition.

Maintenance procedure calls for regular inspection and testing of all hose lines. When damage is found on any Aeroquip line, fittings are removed for future use and the line is replaced with a new assembly made from Pan American's supply of Aeroquip Bulk Hose and Fittings. Important savings are realized because Aeroquip Fittings can be used again and again.

Complete information is available on a full range of Aeroquip Hose and Fitting types for all aircraft. Why not write?

The hose assembly department salvages Aeroquip Fittings and makes hose lines for power plant, hydraulic, and other installations.

PAA Master Mechanic John Jones installs an Aeroquip Hose Assembly on a DC-7 fuel system.

PAA Master Mechanic Myron Rightmyer, of the hydraulic shop, checks inside of hose lines with a glass.

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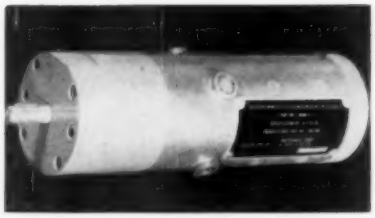


deg. of rotation after the circuit is broken and lock it in that position. It can handle peak loads to 0.4 hp. Application is to control brake flaps for missiles.

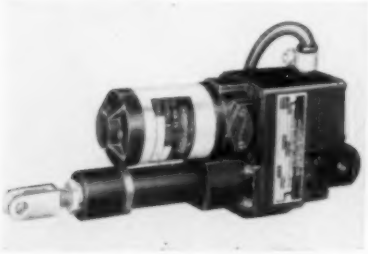
Motor is reversible and has a two-stage planetary gear reduction that delivers 250 rpm. at the output shaft at an armature speed of 15,000 rpm. It is a four-pole series-wound motor 2.1 in. diameter by 6.6 in. long. Unit will operate from −65F to +450F.

Motronics Corp., 241 Concord, Glendale, Calif.

Small Altitude Switch

Miniature barometric pressure switch Model GB-300 can be precalibrated to automatically open or close a circuit at any altitude from 1,000 to 50,000 ft. with a small differential. Weight is 1.75 to 2 oz.

Aircraft Control Division, Gorn Electric Co., Inc., Stamford, Conn.



Load-Sensitive Linear Actuators

R-5160 series 26-v. d.c. load-sensitive linear actuators are available in strokes to 7¼ in. Units feature adjustable load-sensitive switches, magnetic braking, radio noise filter, optional thermal protection, positive stops and an anti-rotation device. Maximum operating load is 650 lb. with 18 in./min. speed. Actuators weigh approximately 2.75 lb. They comply with MIL-A-8064.

Airborne Accessories Corp., 1414 Chestnut Ave., Hillside 5, N. J.

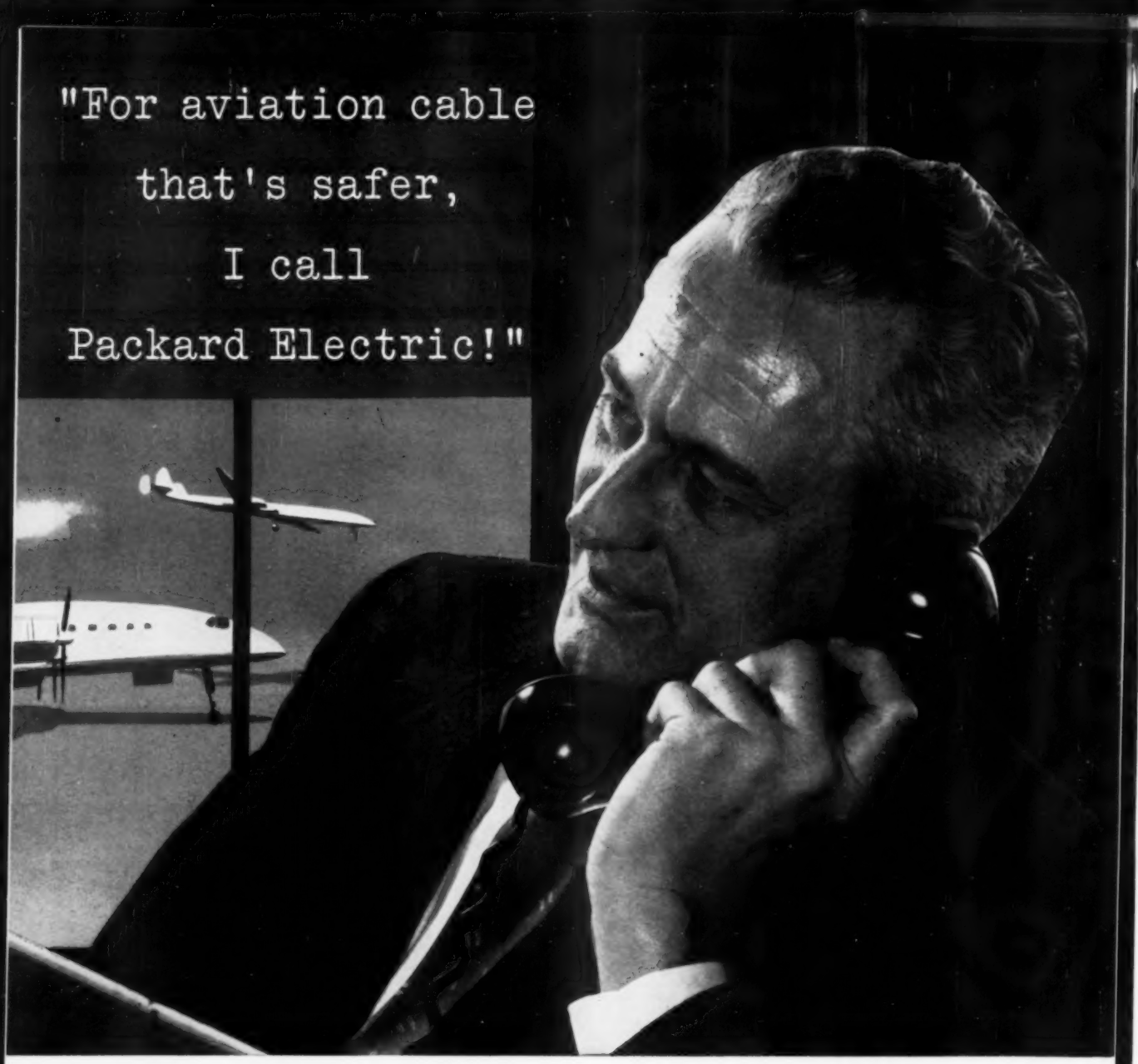
ALSO ON THE MARKET

Ball-bearing push-pull control can manipulate loads up to 1,000 lb. with a stroke up to 8 in. Roller bearings provide friction-free movements of a stainless steel blade in flexible tubing, no lubrication is required.—Controlex Corporation of America, Hangar 18, Westchester County Airport, White Plains, N. Y.

Crossrod conveyorized degreaser, which provides automatic feeding of degreaser, is designed to handle high production cleaning of small metal parts. Unit is available in electric, steam or gas heated models. Vapor level is controlled by a water jacket around tank exterior. Speed: approximately 8 ft per min. Capacity: approximately 3,000 lb. per hr. Size: 8 ft. 3 in. high x 6 ft. wide x 15 ft. long.—Phillips Manufacturing Co., 3415 West Tough Ave., Chicago 45, Ill.

Rate gyro with DC-powered motor that is governor controlled so that output is independent of line voltage. Size: 2⅜ in. diameter x 4⅛ in. long. Weight: 1.7 lb. Units incorporate a potentiometer pickoff and adjustable switches which can be set to close at any desired rate within range of unit. Frequency is in the range of 5-10 c.p.s.—Gobe Industries, Inc., 1784 Stanley Ave., Dayton 4, Ohio.

Standard-circuit modules and breadboard for experimental and prototype assemblies. Layouts can be worked up by plugging in complete basic-circuit modules in breadboard sockets and completing necessary connections with banana plug jumpers plus basic bus-bar



Special insulation on Packard Aviation Cable has greater resistance to abrasion, fire, fuel and oil

PERFORMANCE is up and going higher on today's aircraft and in modern aircraft engines. Specifications are more exacting, right down the line. You'll be glad to know that Packard Cable is abreast of your requirements with special cable and insulation developments that offer greater resistance to abrasion, fire, spilled fuel, oil, hydraulic fluid, extremes of heat or cold, vibration fatigue, and other conditions that airborne equipment is exposed to.

PACKARD ELECTRIC is thoroughly indoctrinated in the uncompromising standards that have guided the aviation industry through its period of unparalleled progress and expansion. Our engineers have been solving cable problems for leading airframe and engine manufacturers since before World War I.

THIS KNOW-HOW, backed by the industry's most extensive research facilities, is your assurance of uniform high-quality cable, designed to the highest performance and safety specifications. And, Packard Electric's tremendous production capacity assures on-time delivery, and a price that is right.

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wiring of breadboard. Available in seven basic circuits or block diagrams.—Distributor Service Division, Acrovox Corp., New Bedford, Mass.

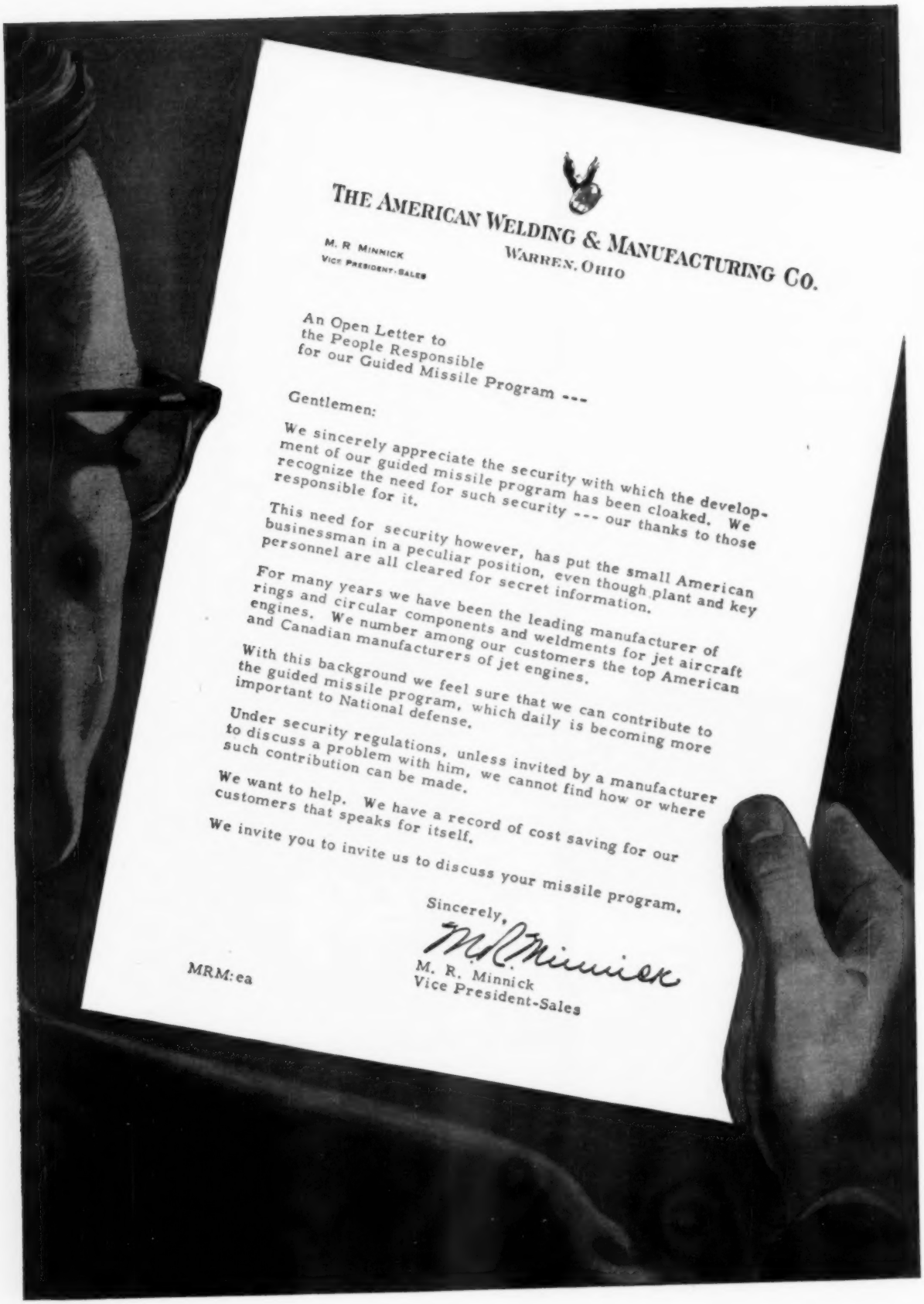
Waterproof, shock-resistant electrical connectors with five assembly styles, series QWL, are being used with multiconductor cable on ground-launching equipment for missiles and ground radar units. Assembly styles provide pin or socket contacts in receptacle or plug. Series uses machined bar stock aluminum resistant to corrosion and abrasion.—Scintilla Division, Bendix Aviation Corp., Sidney, N. Y.

Check-relief valve, for liquid oxygen systems having multi converter installations, maintains a balanced load between converters. Unit acts as a check valve in one direction and a relief valve in the other. Valve conforms to tentative Specification MIL-V-25513 which has replaced Specification MIL-V-9209. —Anderson, Greenwood & Co., 1400 North Rice, Houston, Tex.

R-5140 series rotary actuators have 26 VDC motors which provide magnetic braking. Units include radio noise filter, limit switches externally adjustable throughout entire stroke range, positive stops, optional thermal protection, and anti-rotation device. Speed at max. oper. load of 150 lb. is 12 in./min. Ultimate static load is 600 lb. Unit measures 2⅜ in. x 1⅞ in. x 4.0 in., and weighs 1 lb. Meets Specification MIL-A-8064.—Airborne Accessories Corp., 1414 Chestnut Ave., Hillside 5, N. J.

Low temperature environmental test chamber with a hinged 20 in. x 20 in. access door which may be opened to allow manual instrument changes and adjustments without completely dissipating environmental temperature condition. A 40 horsepower drive shaft penetrating one side of chamber can produce from 750 to 4,500 r.p.m. All automatic programming instrumentation allows for complete pre-setting and pre-selection. Temperature range of —100F to plus 220F. Dimensions: 8 ft. wide x 8 ft. high x 10 ft. deep.—Tenney Engineering, Inc., 1090 Springfield Road, Union, N. J.

Model 640, 8-day elapsed time aircraft clock, is manufactured, tested and regulated in accordance with MIL-C-9196 (USAF). Unit has a precision movement which records time of trip, with independent stopping device. It fits standard panel openings, has a 2¾ in. dial, 12-hour dial with center chronographic sweep second, upper hour register and lower 60 min. register.—Wakmann Watch Co., Inc., 15 West 47th St., New York 36, N. Y.



THE AMERICAN WELDING & MANUFACTURING CO.

WARREN, OHIO

M. R. MINNICK
VICE PRESIDENT-SALES

An Open Letter to
the People Responsible
for our Guided Missile Program ---

Gentlemen:

We sincerely appreciate the security with which the development of our guided missile program has been cloaked. We recognize the need for such security --- our thanks to those responsible for it.

This need for security however, has put the small American businessman in a peculiar position, even though plant and key personnel are all cleared for secret information.

For many years we have been the leading manufacturer of rings and circular components and weldments for jet aircraft engines. We number among our customers the top American and Canadian manufacturers of jet engines.

With this background we feel sure that we can contribute to the guided missile program, which daily is becoming more important to National defense.

Under security regulations, unless invited by a manufacturer to discuss a problem with him, we cannot find how or where such contribution can be made.

We want to help. We have a record of cost saving for our customers that speaks for itself.

We invite you to invite us to discuss your missile program.

Sincerely,

M. R. Minnick

M. R. Minnick
Vice President-Sales

MRM:ea

WHAT'S NEW

Publications Received

Studies for Student Pilots—by Michael Royce—Pub. by Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. $6.00; 282 pp.

Contains complete treatment of the five basic aeronautical subjects that the student pilot must master.

Handbook Preferred Circuits. Navy Aeronautical Equipment, NAVAER 16-1-519—by J. H. Muncy. $1.75. (Order from Government Printing Office, Washington 25, D. C.)

Divided into two parts, Preferred Circuits Manual and Notes to the Preferred Circuits Manual, the handbook presents 32 preferred circuits along with their schematics and characteristics, and explains why they were selected and designed.

Tables of Thermal Properties of Gases—by J. Hilsenrath, C. W. Beckett, W. S. Benedict, L. Fano, H. J. Hoge, J. F. Masi, R. L. Nuttall, Y. S. Touloukian, and H. W. Woolley for the National Bureau of Standards. $3.75; 478 pp. (Order from the Government Printing Office, Washington 25, D. C.)

One of a series of compilations of thermodynamic and transport properties of gases published by the Bureau, this collection of tables covers air, argon, carbon dioxide, carbon monoxide, hydrogen, nitrogne, oxygen and steam.

Machine Tool Electrical Standards—Manual, revised — available from the National Machine Tool Builders' Association, 2071 East 102 St., Cleveland 6, Ohio, upon request. 44 pp.

This latest revision, the work of an Electrical Standards committee of the association, has been approved by the members of the National Machine Tool Builders' Assn. and by its board of directors as an industry standard.

Aviation Facts and Figures, 1956 Edition—Compiled by the Aircraft Industries Association of America—Pub. by Lincoln Press, Inc., 1143 National Press Building, Washington 4, D. C. $1.00; 103 pp.

Reference booklet which records statistics and pertinent facts about United States airpower, military and civil, and the aircraft industry.

Earth Satellites as Research Vehicles—The proceedings of the Franklin Institute's symposium on the peaceful use of satellites (AW April 4, p. 38), is available from the Franklin Institute, 20th and the Parkway, Philadelphia 3, Pa.

SCIENCE AND ENGINEERING

AT LOCKHEED MISSILE SYSTEMS DIVISION

Dr. W. S. Wunch, research specialist in aerodynamics, A. C. Ballaseyus, research engineer, and R. S. Swanson, areodynamics department manager, determine stability derivitives of a high speed missile from flight records.

THE CREATIVE APPROACH TO MISSILE SYSTEMS FLIGHT TEST ANALYSIS

The work of the Aerodynamics Department of Lockheed Missile Systems Division requires a creative approach to flight test planning and analysis. Consequently, research as well as development studies are carried on in flight determination of the performance, stability, control, flutter, aeroelastic, and aero-thermodynamic characteristics of missile airframes.

Scientists and engineers are given full scope to explore new ideas, develop new experimental and evaluation techniques. Among projects of present interest are the development of high-performance free-flight models and other advanced simulation techniques and the accompanying determination of optimum flight plan and instrumentation system characteristics.

The whole spectrum of flight test activities is covered:

1 Application and improvement of experimental planning techniques, including use of probability and statistical theory to improve test result, accuracy, reliability, and usefulness, and to decrease the expenditure of time and money.

2 Determination of range and precision requirements of systems for optimizing results in obtaining aerodynamic, structural and thermal parameters.

3 The development of mathematical and physical analogs for prediction and data for missile performance, control, flutter, aeroelastic and thermal studies.

Those possessing a high order of ability applicable to this field of endeaver are invited to write:

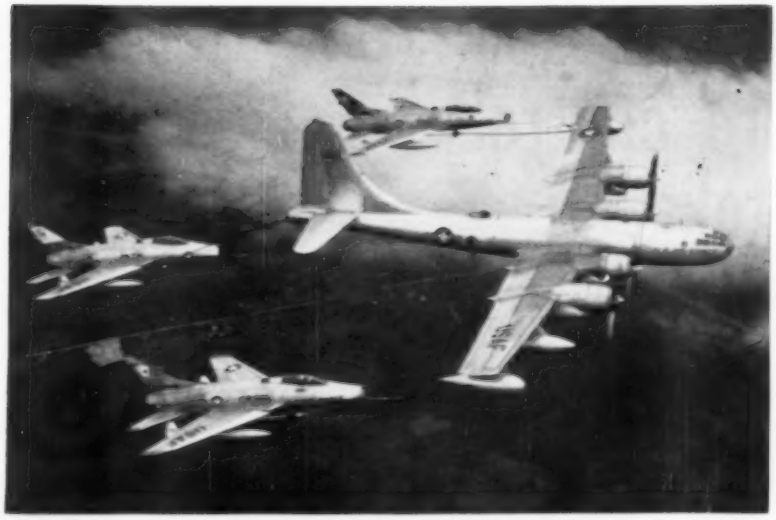
Lockheed

MISSILE SYSTEMS DIVISION

research and engineering staff

LOCKHEED AIRCRAFT CORPORATION

VAN NUYS • PALO ALTO • SUNNYVALE, CALIFORNIA



KB-50 REFUELS three F-100s at once using probe-and-drogue in tests at Eglin AFB.

Boeing KB-50 Tanker Undergoes Three-Drogue Test at Eglin

Eglin AFB, Florida—A version of the Boeing KB-50 tanker providing three-point probe-and-drogue refueling is undergoing a three-month series of operational suitability tests by the Air Force Operational Test Center here. The three drogues are located at the two wing-tips and the tail, permitting the KB-50 to service three aircraft at one time.

With storage tanks in the bomb bay and under the wings, the tanker can carry enough fuel to supply seven F-100 Super Sabres in one mission. During the tests, F-100s and B-66s will be used to evaluate the tanker's performance. Two KB-50s will be used.

Night Missions

For night missions the KB-50 has been outfitted with a battery of high-powered spotlights. A rotating white beacon at the tip of the plane's vertical stabilizer can be seen for 50 miles on a clear night.

The Eglin tests will be supervised by AFOTC's 3245th Test Group (Bombardment).

The center also is beginning operational suitability tests of the turboprop Lockheed C-130 and has received the first of the test aircraft from Lockheed's Marietta, Georgia plant.

The 54-ton C-130 was designed to operate out of unimproved front-line fields and airdrop heavy cargo. Its cargo compartment is larger than a standard railroad freight car. The cargo floor is 41 inches from the ground, permitting easy loading and unloading at truck-bed height.

After familiarization flights at Eglin, the project team will move to Pope AFB, North Carolina to conduct aerial drop tests.

Center 3 Years Old

The Air Force Operational Test Center recently celebrated its third anniversary.

It was activated as a separate unit of the Air Proving Ground Command on July 1, 1953.

Before that time, operational suitability testing was done by the Operational Testing Division of the Deputy Chief of Staff for Operations at command headquarters.

AFOTC evaluates everything from aircraft to movie cameras. Most of the tests are made in the vast area of the Air Proving Ground Command but much work is done at Air Force bases elsewhere in the country and at many foreign sites.

Suitability Tests

A permanent detachment is stationed at Kirtland AFB, New Mexico to test nuclear weapons.

Operational suitability tests conducted by the center are intended to evaluate the efficiency of equipment in the environment for which it was designed.

One of the many facilities at Eglin is the climatic hangar in which the temperature may be dropped to −65F or raised to 165F to show flaws which appear only under extreme climatic conditions.

The hangar is now being operated by the 3206th Test Wing (Technical Support).

New simplified approach to temperature control has superior reliability

Edison Reverses Trend Toward Complexity In Aircraft Accessory Systems

Proved in service on the Douglas C-124 Globemaster, the Convair delta wing F-102, the Boeing B-50 and many other operational aircraft, the Edison simplified temperature control now reverses the trend toward complexity in aircraft accessory systems.

Compact and lightweight, this highly reliable temperature control uses only standard electro-mechanical components—no electronic equipment. Its design simplicity eliminates costly maintenance training. The instrument's checkout procedure is familiar to any electrician.

This basic control teams up with the rugged Edison Fire Detector Cable or with any of Edison's accurate Resistance Temperature Detectors to warn of fire in engines and baggage areas or to signal dangerous temperatures in bearings, heating ducts or oil lines. Simultaneous or selective temperature indication is optional on all overheat detecting systems using RTD's.

Edison field engineers with years of aircraft experience are located in Ft. Worth, Dayton, Glendale, Chicago and West Orange. They will gladly analyze your temperature control problems and recommend action. Just write any of these offices and let us know your requirements.

Thomas A. Edison

A GREAT NAME CONTINUES GREAT NEW ACHIEVEMENTS

Thomas A. Edison

INCORPORATED

INSTRUMENT DIVISION • 49 LAKESIDE AVENUE • WEST ORANGE, NEW JERSEY

Piasecki H-21B Lifts Cargo

Piasecki H-21B helicopter from 18th Air Force, Sewart AFB, Tenn., lifts 3,000 lb. crate of DEW line equipment during tests. Successful airlift tests with the H-21 resulted in disassembly of a helicopter and its airlift to a base on the Alaskan Arctic Coast via 63rd Troop Carrier Wing C-124. The H-21 will move DEW line equipment into Alaskan coastal sites laterally along the ocean to sites where the sea ice is too rough or wavy for the big C-124's to land.

USAF Awards Contract For Optical Devices

Perkin-Elmer Corp., Norwalk, Conn., was awarded a $1,840,090 contract last week for design, development and fabrication of recording optical tracking instruments to be used in the Air Force long-range guided missile test range program.

Under terms of the USAF contract, the firm will build two facilities in Florida to house the instruments, which were described as the largest of the type ever built, and incorporating automatic features. The instruments will be built by the Engineering and Optical Division of the company.

Perkin-Elmer is a supplier of infra-red sensing systems, bombsights, and large aerial photographic lenses as well as such tracking devices.

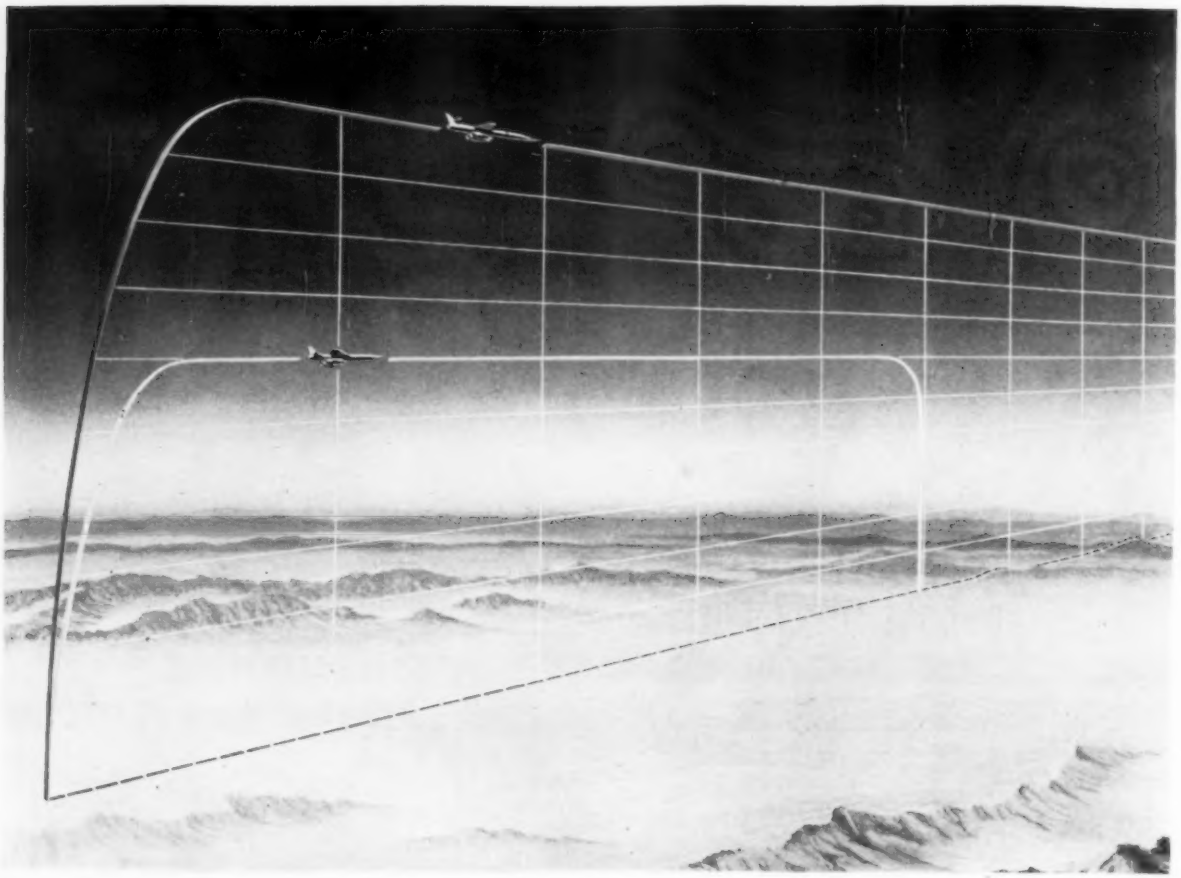
Ground Support Unit Contract to Beech

Additional MD-3 ground support equipment units for jet aircraft will be manufactured under a $12¼ million USAF contract by Beech Aircraft Corp., Wichita, Kan. The contract, the largest single order ever awarded Beech for ground support equipment, specifies delivery of the first units in October, continuing through May.

Beechcraft MD-3 generators have been used by the Air Force since December, 1954, when deliveries began on an emergency order. They were designed for pre-flight and ground test of B-47 medium bombers, but have been used for B-52s and jet fighters.

Vibration Test

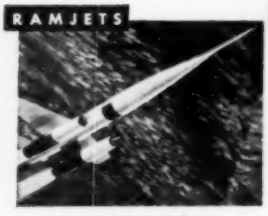
High frequency test being run on electromagnetic high frequency vibration exciter in research laboratory of Robinson Aviation, Inc., Teterboro, N. J., is observed by C. S. Robinson, president of the firm, and G. de Freest Larner, chairman. The equipment is capable of operation up to 2,000 cps.



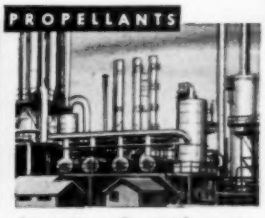
faster, higher, farther... with the fuels of tomorrow

The contribution of Olin Mathieson Chemical Corporation in the development of improved fuels for supersonic aircraft and missiles is an important part of the OMAR program. With Marquardt Aircraft, the West's largest jet engine research and development center, and Reaction Motors, the pioneer in America's rocket industry, Olin Mathieson participates in the joint OMAR program to advance the science of supersonic powerplants and fuels —a science that will mean greater speeds, altitudes, range, and payloads for tomorrow's aircraft and missiles.

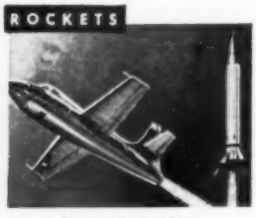
The OMAR program exemplifies the integrated effort of a well-coordinated industrial team . . . combining the chemical and mechanical experience needed for advanced power systems.



Marquardt Aircraft Company
Van Nuys, California



Olin Mathieson Chemical Corporation
New York, New York



Reaction Motors, Inc.
Denville, New Jersey

MARQUARDT AIRCRAFT
OLIN MATHIESON CHEMICAL
REACTION MOTORS

OMAR

4281

Fuel Filter-Dehydrators

This battery of nine fuel filter-dehydrators, installed at San Francisco International Airport by Standard Oil Co. of California, removes all water which might be in aviation fuel pumped at that terminal. The units, each of which has a 600 gpm. capacity, also remove any solid contaminant in the fuel. Features of the devices include: use of renewable cartridges of predensified Fiberglas which unifies any water present into droplets; an automatic ejecting valve to remove water from the bottom of the units as it accumulates, and an automatic slug control which shuts down fuel flow in case large quantities of water are detected in the fuel. Manufacturer is the Fort Wayne Division, Bowser, Inc.

Afterburner Exhaust Heat Measured

A swinging probe to measure the exhaust gas temperature of an afterburning jet engine has been developed and successfully used in flight tests at Ames Aeronautical Laboratory, NACA.*

Use of the probe in a series of flight tests showed that the net thrust of the installed powerplant and ducting could be measured to about 5%.

Using two sonic-flow orifices in series, the probe measures the temperature of the gas stream as a difference in pressure. Calibration indicates the probe to be correct within about 10F, with a system time lag of less than 0.05 sec.

Possible other uses of the probe include: free-stream static-temperature indicator, in conjunction with a simple computer to correct the Mach number, and a tailpipe temperature indicator for afterburner operation.

Reason for the development of the swinging probe was to make complete exit surveys of the flow from the engine. This is one of two possible ways to determine jet exit flow; the other is to instrument all the inlets to sum up the individual mass flows.

With the exit mass flow and momentum measured, the actual performance of the engine installation can be determined. This result can be used to determine the actual airplane drag.

* *A Sonic-Flow Orifice Probe for the In-Flight Measurement of Temperature Profiles of a Jet Engine Exhaust with Afterburning (TN 3714); By C. Dewey Havill and L. Stewart Rolls, Ames Aeronautical Laboratory.*

PRODUCTION BRIEFING

Bellows Co., pneumatics manufacturer of Akron, Ohio, is erecting a new West Coast office at Glendale, Calif., which will serve as headquarters for both the Bellows Co. of California and the Smith Johnson Manufacturing Division of the Bellows Co.

Reeves Instrument Corp., New York, has established a Metropolitan New York sales office for their REAC analog computers, and other servomechanism components. The office will be located at the Manhattan plant.

Epoxy-glass laminate for checking the alignment of the Lockheed C-130 Hercules upper front window area is made of glass cloth and Bakelite plastic (distributed by Rezolin Los Angeles as Toolplastic).

Harvey Aluminum, Torrance, Calif., a division of Harvey Machine Co., announces it is in full production on 6066 wrought alloy aluminum in hollow bar

stock. Standard rounds are available from 1 in. through 2½ in. in ⅛ in. increments and 2⅝ through 3½ in. in ¼ in. increments. Wall thicknesses vary from .109 to .500 with other sizes subject to mill inquiry.

Aircraft connector problems were discussed at a recent symposium sponsored by the Deutsch Co., Huntington Park, Calif. Meeting open to both airframe users and competitors was frank attempt by Deutsch to gather industry information and comments upon which to base design of their new line of connectors.

Boral is now being supplied commercially by Brooks & Perkins, Inc., Detroit. Consisting of a core of boron carbide clad on both sides with pure aluminum, Boral is used for neutron shielding in atomic energy installations.

Republic Aviation says that this large single-piece F-84 forging is one of the largest ever made for a fighter-bomber.

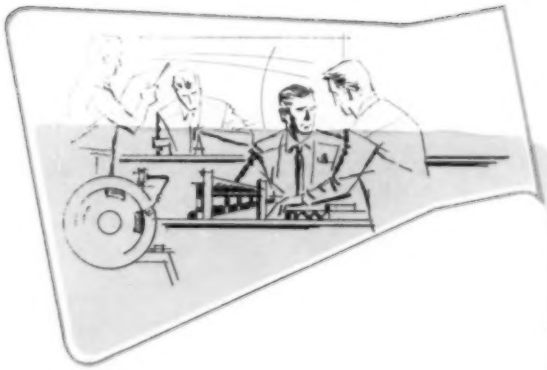
Narda Corp., Mineola, N. Y., has two European sales outlets for its microwave and UHF test equipment. The company says that this is the result of the growing electronic and aviation industries in the two countries concerned, Belgium and Sweden. The representatives are Regulation-Measures, Brussels, Belgium and Elektronik-Vologet AB of Stockholm, Sweden.

James-Pond-Clark, Pasadena, Calif., check valve manufacturer, announces that its new name will be Circle Seal Products Co., Inc.

Beryllium Corp., Reading, Pa., has a new fully-staffed warehouse in Detroit to serve that area better with its Berylco beryllium copper master alloys, casting ingots, rod, bar and billets.

Lima Electric Motor Co., Lima, Ohio, has opened a new branch office in Detroit.

Silicone Products Dept., General Electric Co., Waterford, N. Y., has added a silicone rubber cloth coating compound to its silicone products. Designated SE-701, this compound will allow ducts to carry air at temperatures



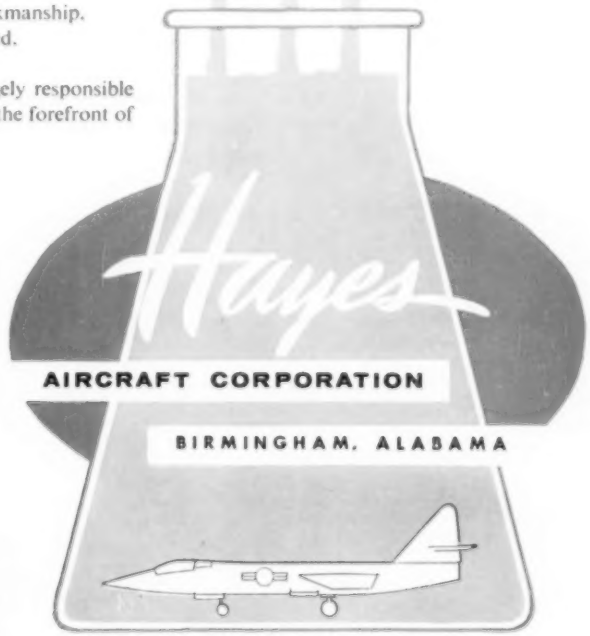
THE PRICELESS INGREDIENT

At Hayes Aircraft there is an invisible force, with neither shape nor form. Yet this intangible element has set Hayes apart in a field of its own and is a prime reason for the Company's growth. This priceless ingredient is the personal *integrity* of Hayes craftsmen — the engineer with his problems of design, the procurement personnel who obtain raw materials, the scientist in his laboratory, the machinist, the electrician, the test pilot, the sheet metal worker, the detail craftsmen — each taking pride in his individual contribution to the overall operation.

Working together as a group the result is:

- Quality control of materials and workmanship.
- Delivery schedules consistently fulfilled.
- Costs that are competitive.

Thus, this priceless ingredient of *integrity* is largely responsible for placing Hayes Aircraft, in five short years, at the forefront of aircraft modification and overhaul.



POSITIONS OPEN FOR ENGINEERS

With nearly 6,000 employees, Hayes is now a competitive industrial facility for modification and maintenance of aircraft — including largest size planes.

Opportunities open for experienced design engineers, graduate and undergraduate engineering students. Write Personnel Department.

ENGINEERS · DESIGNERS · MANUFACTURERS

WANTED! ENGINEERS TO HELP MAKE LONG RANGE MISSILE HISTORY

North American's Missile Projects Offer A New Engineering Adventure

With complete weapons system responsibility for the SM-64 NAVAHO Intercontinental Guided Missile, North American is engaged in one of the most challenging programs yet offered. But every inch of progress is a tough scientific battle. New means are daily being found to solve the complex problems which the development of long range missiles presents in the fields of structures, temperatures and aerodynamics. But most important of all, *men* must be found who thrive on this kind of challenge . . . men who are really excited about this new missile science. Are you one of them?

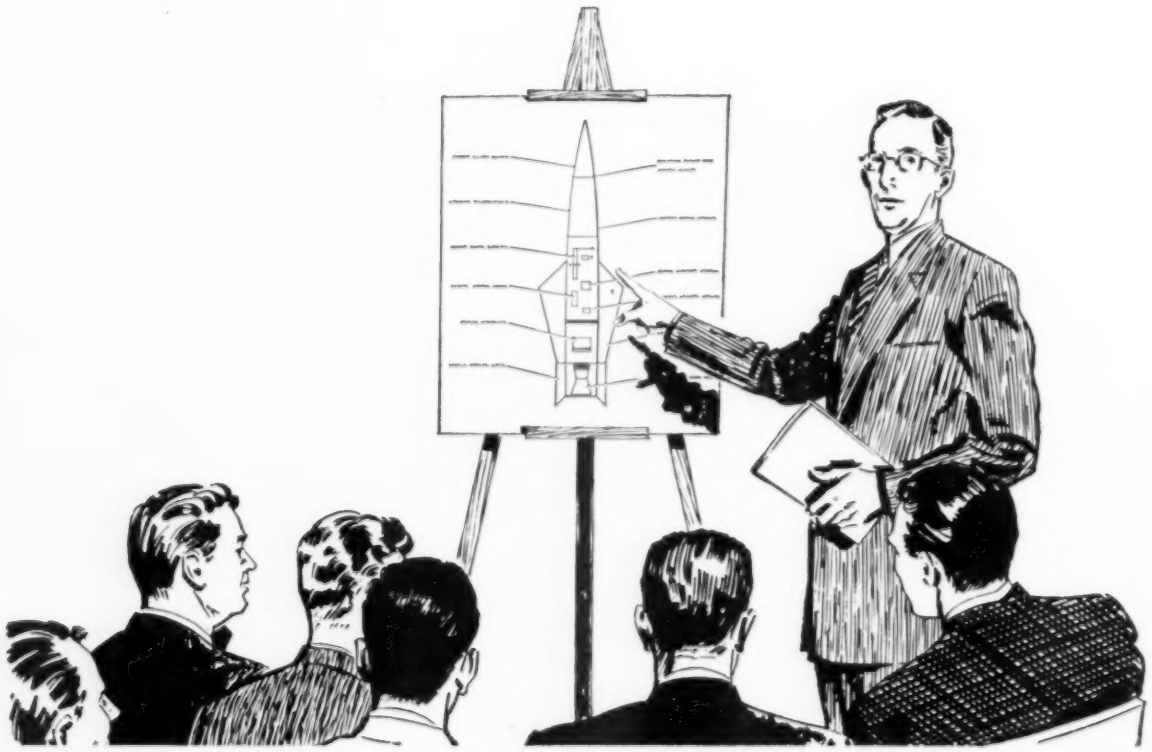
If you qualify in one of the fields we have listed below, chances are you can qualify for this unique expedition into the technology of the future. We would like to tell you about all the physical and professional advantages of a career in North American's Missile Development Engineering.

Please contact us for the full story:

Instrumentation Design, Development & Application **Standards, Drawings Checking, Specifications Writing**
Structures, Stress, Flutter and Aeroelasticity **Component and System Reliability Engineering** **Thermodynamics**
Missile Airframe Design **Hydraulic, Pneumatic & Servo Engineering** **Armament Systems & Components Engineering**
Aerodynamics **Engineering Flight Test** **High Temperature Materials Engineering** **Mechanical & Electrical Design**

Contact: R. L. Cunningham, Missile Engineering Personnel Office
Dept. 91-20 AW, 12214 Lakewood Boulevard, Downey, Calif.

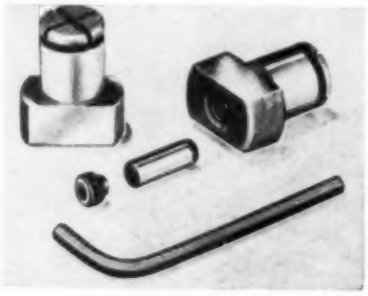
NORTH AMERICAN AVIATION, INC.



as high as 700F or as low as 120F. It is said to have resistance to Skydrol 500 and 700, JP4, gasoline, MIL-o-7808 and MIL-5606.

Rolls-Royce's Hillington plant near Glasgow, Scotland, is producing 173 Merlin engines at $2,800,000 for the Spanish Air Ministry.

Sine Fixture Key is said to save up to 50% labor costs in laying out and milling fixture base plates because the



stemmed construction eliminates the usual milling operations. Jergens Tool Specialty Co., Cleveland, Ohio.

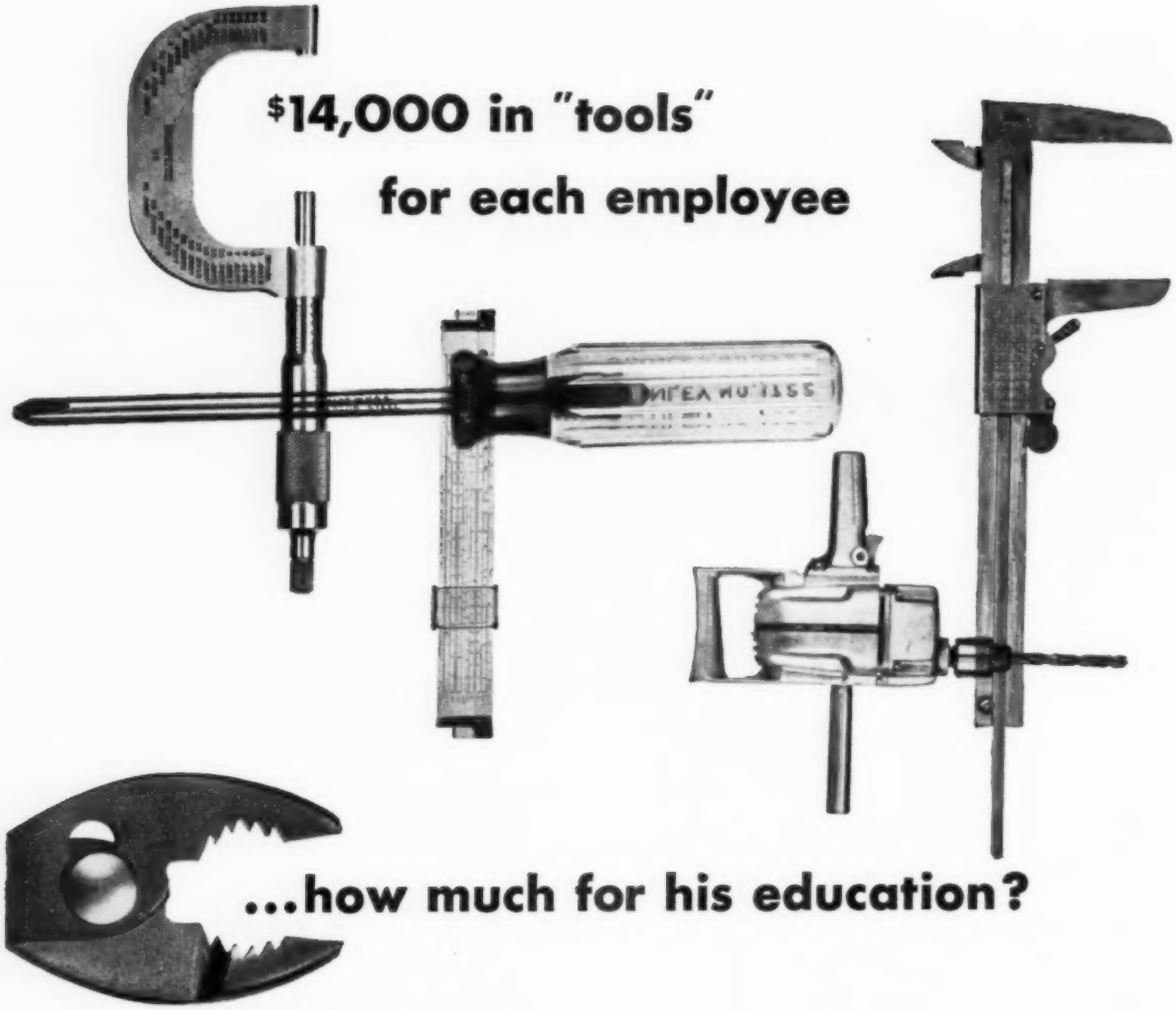
Coast Manufacturing & Supply Co., Livermore, Calif., has opened an engineering service facility in Chicago. Marketing under the name "Trevarno Glass Fabrics," Coast manufactures fiberglas fabrics, plain, finished, or impregnated with Epoxy, Silicone, Phenolic or polyester resin systems.

Schori Process Division of Ferro-Co. Corp., Maspeth, N. Y., is doubling its production space to 60,000 sq. ft. to meet the increased demand for Iolyte laminated fiberglas products. Because of its resistance to certain chemicals, the company says that Iolyte has been widely used for plating tanks, fume hoods and filter press troughs.

Standard Insulation Co., East Rutherford, N. J., announces that it has provided special cold storage areas for its new line of Stampreg preimpregnated materials in the recent addition to its plant.

Tenney Engineering, Inc., Union, N. J., leading engineers and manufacturers of refrigeration and environmental test equipment have named Alta Engineering Co., Denver, as exclusive sales engineering representatives for Tenney environmental equipment in the Rocky Mountain area.

Applicants for New York University's second annual Titanium lecture Sept. 10 through 14, may register by writing Dr. Harold Margolin, N. Y. U. College of Engineering, University Heights 53, N. Y.



$14,000 in "tools" for each employee

...how much for his education?

Today, business invests an average of $14,000 in each employee's job. The question for businessmen is: Are we training enough people who can hold down these jobs? Schools are the answer. And it's simple self interest to help community groups get the teachers and equipment schools need. Shortage right now: 200,000 classrooms, 165,000 teachers!

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Want to find out how to help in *your* community?
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Better Schools, 9 East 40th Street, New York, N. Y.

CHILD faints, his pulse rate at 200.

MEDICAL assistant administers Oxygen.

BOY revives quickly, his cough ceases.

Brazilian Airlift Treats Whooping Cough

By Peter Weaver

Rio de Janeiro—In the dim light of an apartment in Rio, a child was coughing, turning red then purple from lack of air. A doctor was called. His prescription: *Servico Aereo de Coqueluche.*

The service is an airlift run by the Brazilian Air Force, probably the only one of its kind in the world. *Coqueluche* is a Brazilian word for whooping cough. And in Brazil whooping cough is one of the most dreaded child's diseases, yearly attacking hundreds of thousands.

In 1941, some Air Force doctors found that if a child stricken with whooping cough was quickly flown up to around 12,000 ft. and kept at that altitude for more than an hour, the coughing stopped. In many cases a complete cure was noted after one to three flights.

Flights Are Free

Now the Air Force has a special depot at Santos Dumont Airport in downtown Rio for whooping cough victims.

This month an extra flight was added to the service to provide four scheduled flights a week in specially equipped C-47 aircraft. The service also includes non-scheduled flights in the interior for communities hard hit by the disease. All flights are free to anyone with a doctor's prescription. Last year, the service hauled more than 11,000 children. This year the total is expected to be over 15,000.

Why the 12,000 ft. altitude helps combat whooping cough is a mystery, but the results are often termed miraculous. Capt. Tito Livio Job, an Air Force doctor who heads the service, gives this opinion:

"The lungs have to work much harder at that altitude to get rarified oxygen. (Beyond 12,000 feet is not practical because there is too little oxygen.) The extra pumping of the lungs causes an increased flushing out of carbon dioxide, which in turn gives the system higher alkalinity (less carbonic acid formed). The alkalinity supposedly increases, or peps up, blood cells that fight off the disease, thus putting the patient on the road to recovery."

Doctors do not agree on this theory and some call the airlift a waste of time.

The Air Force admits that all children are not cured by the treatment. But the Air Force claims more than 60% of all children carried have recovered in record time, in many cases in less than a week.

To apply for the service, a Brazilian parent has to have a note from a doctor stating that the child really has whooping cough and is in good enough condition to make the flight. The parent then goes to the base and is checked in by an Air Force doctor and scheduled for a flight.

Warm Clothing

Parents are warned to bring warm clothing to guard against the near-freezing temperatures. A child under seven years old must be accompanied by a parent or guardian.

The crew on the C-47 consists of a pilot, copilot, mechanic, radioman, Air Force doctor and two medical corpsmen. The children and parents are strapped into bucket seats lining the sides of the plane and the doctor stands by with oxygen. Usually there are 40 children on a flight and enough oxygen is in store for all of them if necessary.

Climbs at 590 fpm.

After take-off the C-47 climbs at 590 fpm. to around 11,500 ft. At this altitude the pilot sets a course for Cabo Frio where there is flat coastland and less chance of turbulence. The children usually whoop and cough lustily until the plane levels off at cruising altitude. Then coughing begins to stop. The doctor checks respiration, and pulse repeatedly and often orders sniffs of oxygen for babies with erratic breathing or too rapid pulse.

During one flight, a little boy fainted. He was a year and a half old and the whooping cough had left him pale and with big dark spots under his eyes.

The doctor checked his pulse. It was a dangerous 200. Oxygen was given, and the boy came around, cried a little and went to sleep.

"This service sort of gets you . . . they don't keep us on it long," one sergeant said as he pointed to the pathetic cargo of white faces and skinny bodies.

Actually, the Air Force gets double duty out of its *Servico de Coqueluche.* The flight crew is often given navigational and procedural problems for training. During many of these special flights, the copilot's seat is surrounded

This Hermetic Integrating Gyro is the heart of Honeywell's self-contained, non-radiating, inertial navigation and guidance systems. Relying solely on inertial sensing devices, these systems can, unaided, direct missiles and aircraft to target or destination. This represents another milestone in flight guidance, made possible by Honeywell's advanced gyro design.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL

WHOOPING COUGH airlift uses C-47 as a street car. One line waits to board as another gets off.

with a green mask for logging in blind flying time.

While the flight drones on, most of the children usually fall asleep, bundled in parents arms. But some still walk around and are entertained by the flight crew with paper planes and are given occasional peeks into the flight cabin.

After an hour, the plane descends (502 fpm.) to a landing at Santos Dumont where another line of children and parents waits. One doctor, standing by to go on a flight, shrugged his shoulders, saying, "Maybe its all in their minds . . . we're not sure what happens to them, but so many walk away from here after a few flights and never whoop or cough again . . . They put on weight and get their color back."

WHEN 12,000 ft. altitude is reached, children stop coughing as this one is doing.

Because of the growing line of parents and children waiting for flights, the government is enlarging the service. Now the only scheduled runs are in Rio. Next year there probably will be regular service in at least three other major cities.

CAB Approves Brazilian Route Into Chicago

Washington—Aerovias Brasil's international route to the United States has been extended to Chicago by the Civil Aeronautics Board.

With the new terminal, Aerovias Brasil will be able to offer through service from Chicago to points in the Caribbean area and Rio de Janeiro, Sao Paulo, Montevideo and Buenos Aires. The airline plans to begin service within the near future with a weekly DC-4 flight.

Extension of the route of Empresa de Transportes, Aerovias Brasil S. A. from its present terminal at Miami gives the carrier a route already provided for in the bilateral air agreement between Brazil and the United States.

Aerovias Brasil's permit now allows the carrier to operate between points in Brazil and New Orleans, Miami and Chicago via Paramaribo, Georgetown, Port of Spain, Caracas, Ciudad Trujillo, Camaguey and Havana.

New York Dedicates Air Cargo Center

New York—The Port of New York Authority last week dedicated its new $5.5 million air cargo center at New York International Airport. The five-structure development, covering 80 acres, contains four one-story 80x750-ft. air cargo buildings and a two-story air cargo service building for federal inspection services, freight forwarders, customs brokers, warehouse service, and cartage companies. The cargo buildings provide freight handling and office space for 27 airlines. Total floor area of the five buildings is 309,000 sq. ft.

Air Express International Announces Moscow Rates

Air Express International has announced through cargo rates to Moscow in anticipation of freer trade relations between the U. S. and Russia. They are $1.70 per lb. for 100 lbs. or less, $1.43 per lb. for shipments over 100 lbs.

AEI expects third or fourth morning arrival in Moscow. Shipments are limited to non-strategic materials and those not used in construction.

Figures Released for Fiscal 1957 Federal Aid Airport Projects

The airport-by-airport breakdown of the $51,863,177 Federal Aid airport projects for Fiscal 1957 (AW June 18, p. 39) follows:

ALABAMA

Birmingham Municipal Airport	$830,500
Huntsville Airport	96,000
Montogomery Dannelly Field	156,613
Muscle Shoals Airport	25,000
Tuscaloosa Van deGraaff Airport	142,000

ARIZONA

Casa Grande Municipal Airport	5,609
Bisbee-Douglas Int'l. Airport	44,372
Flagstaff Municipal Airport	27,785
Sky Harbor Municipal Airport, Phoenix	316,478
Prescott Municipal Airport	10,795
Safford Municipal Airport	32,935
Oak Creek (Sedonia) Airport	12,198
Tucson Municipal Airport	172,240

ARKANSAS

Fort Smith Municipal Airport	32,500
Springdale Municipal Airport	29,875

CALIFORNIA

Alhambra Heliport	11,208
Auburn Municipal Airport	4,498
Kern County #1 Airport, Bakersfield	92,055
Beckwourth Airport	12,464
Calexico Municipal Airport	25,252
Buchanan Field, Concord	45,206
Fresno Air Terminal	22,110
Half Moon Bay Airport	18,425
Antelope Valley Airport, Lancaster	396,617
Los Angeles Int'l. Airport	1,250,000
Monterey Peninsula Airport	40,643
Napa County Airport	18,967
Metropolitan-Oakland Int'l. Airport	1,250,000
Palomar Airport, Oceanside	137,290
Ontario Int'l. Airport	30,851
Oroville Municipal Airport	5,419
Brackett Field, Pomona	532,908
Porterville Airport	7,000
Salinas Airport	16,257
San Francisco Int'l. Airport	130,485
San Jose Municipal Airport	359,659
Orange County Airport, Santa Ana	41,184
Santa Barbara Municipal Airport	77,557
Santa Maria Public Airport	8,826
Santa Monica Municipal Airport	20,056
Santa Ynez Airport	5,021
Susanville Airport	31,376
Ukiah Municipal Airport	24,000

COLORADO

Alamosa Municipal Airport	5,325
Boulder Municipal Airport	12,780
Municipal Airport, Craig	50,597
Walker Field, Grand Junction	94,784
Kelsey Field, Lamar	14,342
San Luis Valley Airport, Monte Vista	32,748
Montrose County Airport	7,989
Nucla-Montrose County Airport	5,859
Pueblo Memorial Airport	401,690
Sterling-Logan County Airport	24,766

CONNECTICUT

Bridgeport Municipal Airport	5,500
Danbury Municipal Airport	36,000
New Haven Municipal Airport	75,000
Bradley Field, Windsor Locks	223,500

DELAWARE

NONE

FLORIDA

Daytona Beach Municipal Airport	250,000
Broward Int'l. Airport	30,000
Page Field, Fort Myers	6,000
Thomas Cole Imeson Airport, Jackson	8,510
Kissimmee Municipal Airport	12,250
Drane Field, Lakeland	31,000
Melbourne-Eau Gallie Municipal Airport	15,000
Miami Int'l. Airport	1,250,000
Orlando Municipal Airport	87,500
Fannin Field, Panama City	61,000
Pinellas County Int'l. Airport, St. Petersburg	33,000
Sarasota-Bradenton Airport	18,000
Tallahassee Municipal Airport	300,000
Tampa Int'l. Airport	60,000
Venice Municipal Airport	5,500
Park Airport, West Palm Beach	40,000

GEORGIA

Atlanta Airport	1,250,000
Carrollton Municipal Airport	50,500
Macon Municipal Airport	140,000
Thompson Field, Swainsboro	10,000
Waycross-Ware County Airport	25,000

IDAHO

Idaho Falls Municipal Airport	97,510
Moose Creek Airport	28,139
Idaho portion of Pullman-Moscow project (See program for Washington)	7,632

ILLINOIS

Aurora Municipal Airport	72,000
Murdale Airport	20,000
Centralia Municipal Airport	7,000
Chicago-Midway Airport	289,400
O'Hare Field—Chicago	1,250,000
Airport, Danville	10,000
Decatur Municipal Airport	72,700
Freeport Municipal Airport	37,000
Galesburg Municipal Airport	45,000
Harrisburg-Raleigh Airport	7,000
Jacksonville Municipal Airport	7,000
Williamson County Airport	8,000
Mount Vernon Municipal Airport	58,000
Greater Peoria Airport	219,000
Quincy Baldwin Field	45,000
Greater Rockford Airport	130,000
Salem-Lecrone Field	50,000
Capital Airport, Springfield	13,000
Whiteside County Airport	10,000
DuPage County Airport	171,500

INDIANA

Baer Field, Fort Wayne	12,000
Municipal Airport	125,000
Municipal Airport	10,500
Municipal Airport	296,792
Municipal Airport	31,500
Municipal Airport	66,650
Municipal Airport	125,000
Municipal Airport	17,250
Muncie Airport	105,000
Hulman Municipal Airport, Terre Haute	25,000
Porter County Municipal Airport	38,046

IOWA

Boone Municipal Airport	12,500
Davenport Municipal Airport	26,250
Fort Dodge Municipal Airport	10,895
Sac City Municipal Airport	9,800

KANSAS

Eskridge State Park Airport	32,500
Garden City Municipal Airport	17,500
Iola Municipal Airport	9,700
Leavenworth State Park Airport	32,500
Oswego State Park Airport	32,500
Atkinson Municipal Airport, Pittsburg	1,500
Salina Municipal Airport	100,000

KENTUCKY

Municipal Airport, Bowling Green	65,000
Greater Cincinnati Airport	497,767
Capital City Airport, Frankfort	95,000
Marshall Field, Georgetown	21,500
Hazard Airport	35,600
Blue Grass Airport, Lexington	50,000
Standiford Field, Louisville	487,500
Owensboro-Daviess County Airport	23,000
Barkley Field, Paducah	18,625

LOUISIANA

Lafayette Airport	85,000
Lake Charles Municipal Airport	400,000
Moisant Int'l. Airport, New Orleans	1,250,000

MAINE

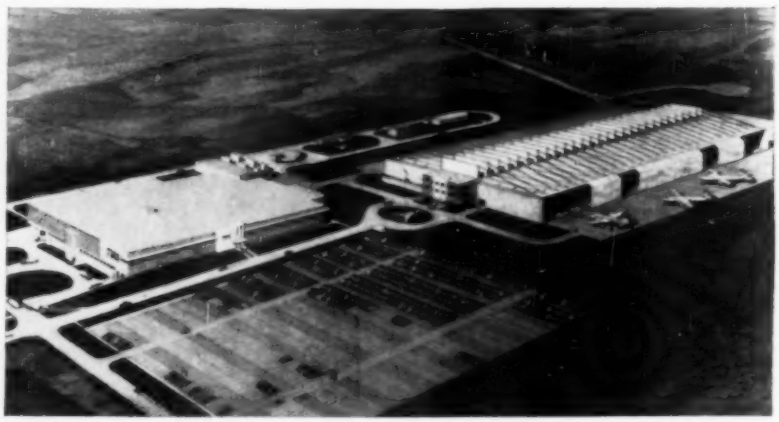
Lewiston-Auburn Airport	38,500

MARYLAND

Hagerstown Municipal Airport	393,500
Montgomery County Airport	50,000

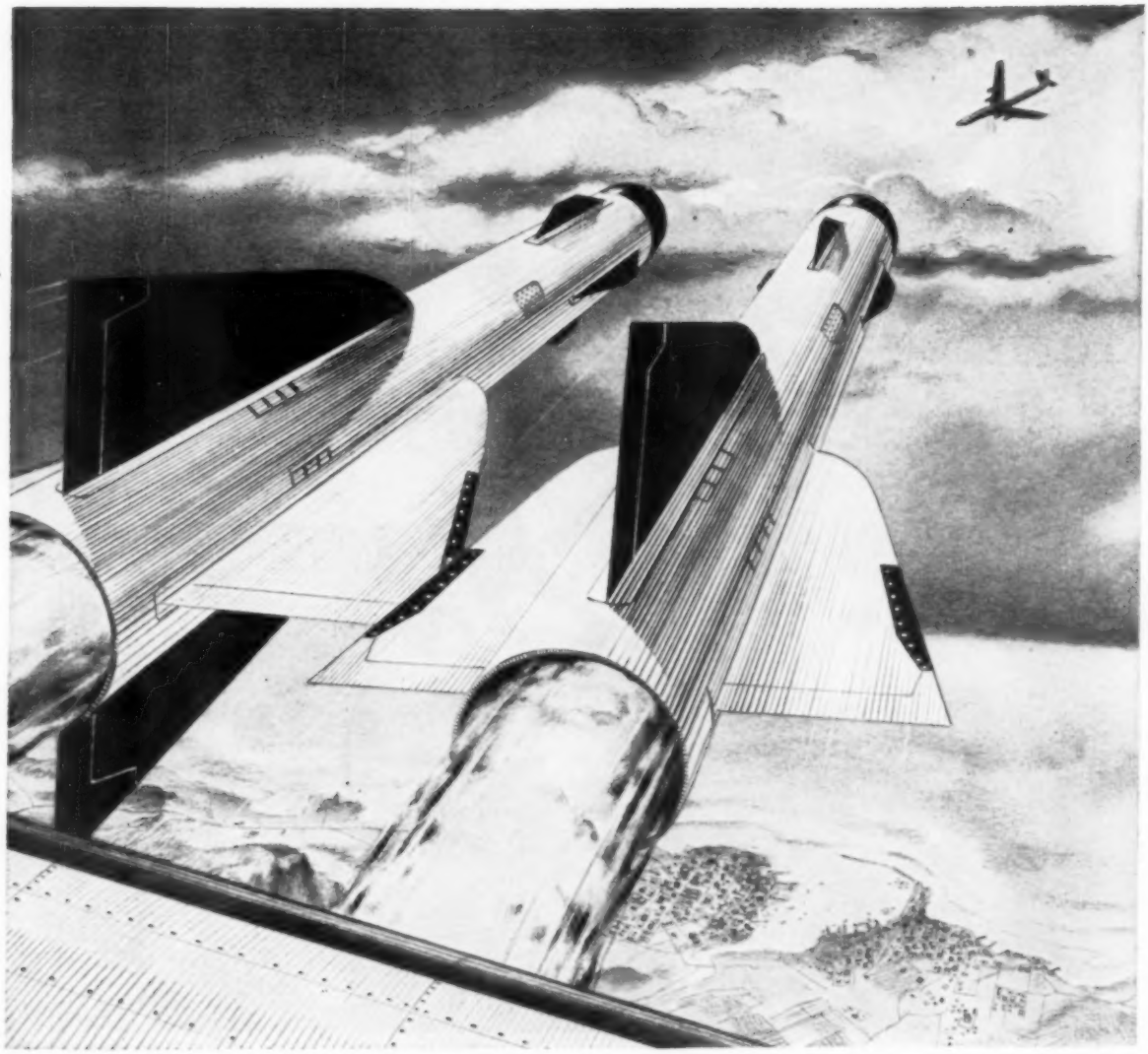
MASSACHUSETTS

Barnstable Municipal Airport	202,000
Logan Int'l. Airport, Boston	407,500
Chatham Municipal Airport	47,950
Fitchburg Municipal Airport	10,000
Gardner Municipal Airport	22,500



TWA's New Overhaul Base

Trans World Airlines has moved its engine maintenance activities from its old overhaul base at Fairfax Airport, Kansas City, Kan., to this new structure at the Midcontinent International airport which the city of Kansas City, Mo., is building. The airframe hangar (right) will be completed early next year. The engine facility is producing six engines a day. It is designed to use 5,000 hp. capacity dynamometers for engine test, and is convertible to turbine engine overhaul when TWA begins to operate Boeing 707s.



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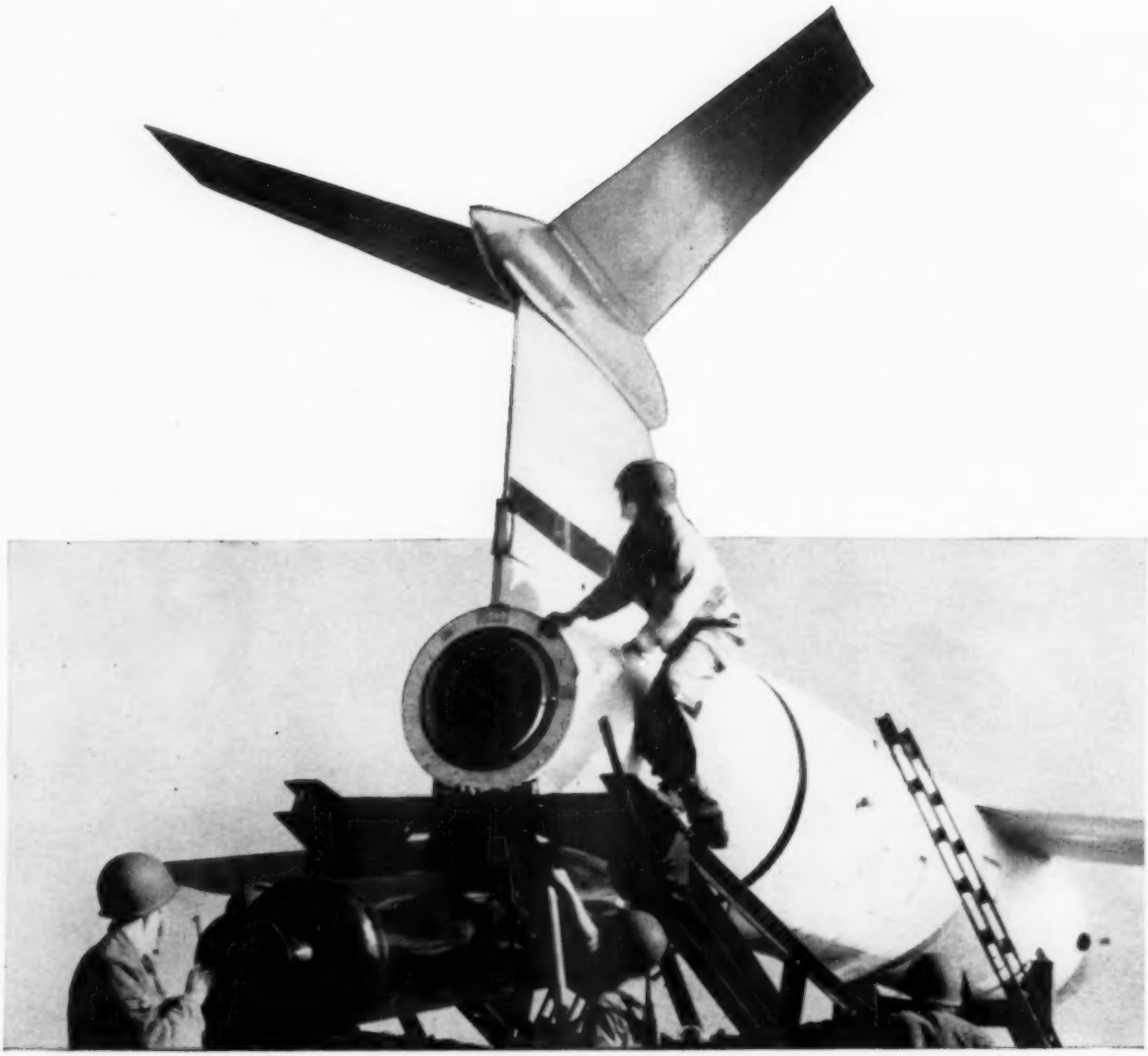

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Those were the materials that have proved out one of the big engineering achievements of our time. It concerns a whole new concept of *customer service* developed to provide optimum efficiency in the delivery and performance of weapon systems.

The TM-61 Martin Matador shown here at an overseas Air Force base arrived there in six packing cases, and was stockpiled in a storage depot.

When the test-drill whistle blew, a team of Air Force technicians assembled and checked out the missile, complete with mobile guidance system, and ready for firing, in less than six hours.

Martin engineering service today covers every aspect of the customer's requirements for effective operation and maintenance of the product. This includes packaging, delivery, customer training, field service and contractor maintenance.

MARTIN

Gloucester Municipal Airport	41,500
Gosnold Cuttyhunk Airport	20,000
Mansfield Municipal Airport	35,625
Pittsfield Municipal Airport	607,750
Plymouth Municipal Airport	61,635
Worcester Municipal Airport	88,388

MICHIGAN

Adrian City Airport	19,000
Ann Arbor Municipal Airport	9,000
Huron County Memorial Airport	7,250
Ross Field, Benton Harbor-St. Joseph	90,000
Detroit-Wayne Major Airport	1,000,000
Memorial Airport, Dowagiac	24,000
Iosco County Airport	23,000
Escanaba Municipal Airport	87,500
Bishop Field, Flint	40,000
Grand Haven Memorial Airport	10,000
Houghton County Memorial Airport	25,000
Ford Airport, Iron Mountain	29,000
Gogebic County Airport	5,000
Reynolds Municipal Airport, Jackson	94,000
Kalamazoo Municipal Airport	80,000
Capital City Airport, Lansing	153,000
Marquette County Airport	45,000
Mount Pleasant Municipal Airport	50,000
Muskegon County Airport	80,600
Jerry Tyler Airport, Niles	50,000
Pontiac Municipal Airport	31,500
Kirsch Airport, Sturgis	29,500
Dr. Haines Flying Field, Three Rivers	17,000

MINNESOTA

Faribault Municipal Airport	20,000
Municipal Airport, Fergus Falls	10,000
Hibbing Municipal Airport	7,500
Mankato Memorial Airport	25,000
Wold-Chamberlain Airport, Minneapolis	1,250,000
Park Rapids Municipal Airport	22,500
Redwood Falls Municipal Airport	30,000
Rochester Municipal Airport	150,000
Willmar Municipal Airport	70,000

MISSISSIPPI

Greenwood Municipal Airport	50,000
Jackson Municipal Airport	400,000
University-Oxford Airport	31,000

MISSOURI

Cape Girardeau Municipal Airport	30,000
Columbia Municipal Airport	30,000
Hannibal Municipal Airport	46,500
Int'l. Airport, Kansas City	800,000
Kansas City Municipal Airport	200,000
Rosecrans Memorial Airport, St. Joseph	24,250
Lambert-St. Louis Municipal Airport	950,000
Springfield Municipal Airport	17,000

MONTANA

Billings Municipal Airport	17,167
Great Falls Municipal Airport	29,854
Missoula County Airport	25,000
Plentywood City-County Airport	66,650

NEBRASKA

NONE

NEVADA

Elko Municipal Airport	31,250
McCarran Field, Las Vagas	293,348
Reno Municipal Airport	481,250

NEW HAMPSHIRE

Berlin Municipal Airport	15,000
Municipal Airport, Laconia	23,000
Lebanon Municipal Airport	250,000
Boire Field, Nashua	26,327

NEW JERSEY

Newark Airport	685,000
Mercer County Airport	223,928
Cape May County Airport	5,150

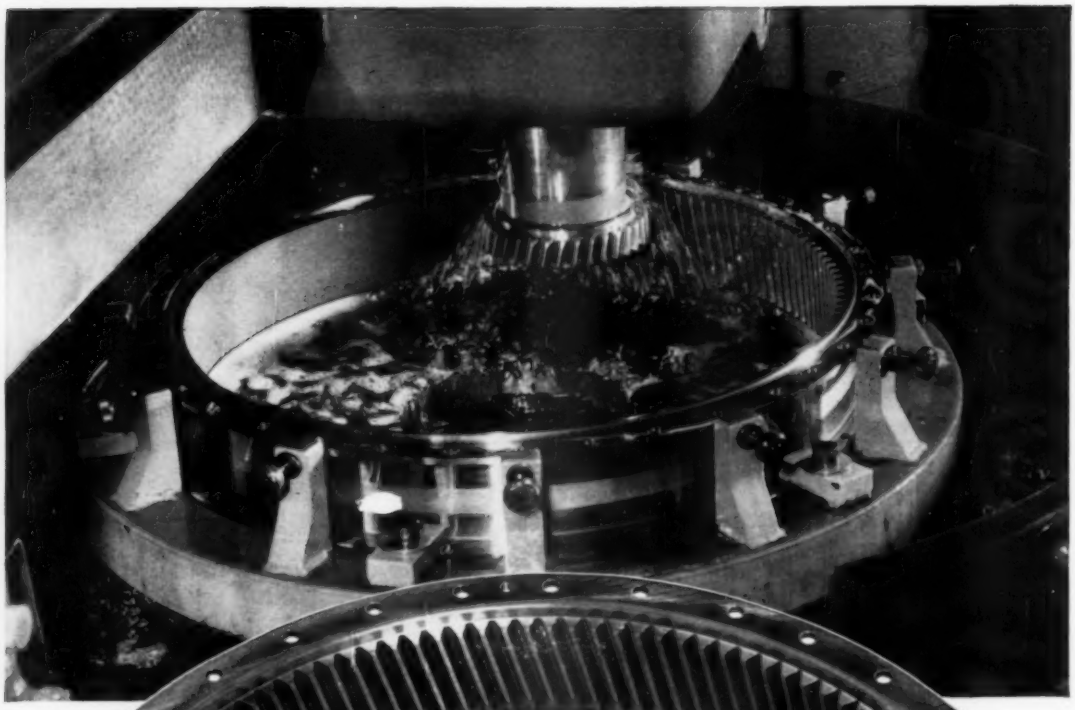
NEW MEXICO

Carlsbad Municipal Airport	83,000
Lea County Airport	89,192
Tucumcari Municipal Airport	73,898

NEW YORK

Albany Municipal Airport	218,700
Chemung County Airport	25,450
Elizabeth Field, Fishers Island	8,500
MacArthur Airport, Islip	152,000
Jamestown Municipal Airport	110,000

and then we built



This 7 pitch, 19.1564″ pitch diameter internal gear for the Sikorsky S-58 Main Transmission

This HARD (Rockwell "50C") gear is cut after heat treating to master gear standards:

.0002″ per inch maximum lead error
+.0000 −.0003 involute error
.0002″ tooth spacing tolerance
60 RMS finish

INDIANA GEAR

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Liberty Airport	315,500
Richards Field Massena	81,055
New York Int'l. Airport	1,250,000
Ogdensburg Municipal Airport	12,500
Olean Municipal Airport	237,500
Rochester-Monroe County Airport	165,550
C. E. Hancock Airport, Syracuse	287,500
Oneida County Airport	57,750
Wellsville Municipal Airport	22,000
Westchester County Airport	88,000
NORTH CAROLINA	
Douglas Municipal Airport, Charlotte	113,000
Greensboro-High Point Airport	165,675
Hickory Municipal Airport	66,500
Lumberton Municipal Airport	6,533
Raleigh-Durham Airport	25,000
Rowan County Airport	150,000
Shelby Municipal Airport	167,020
Smith Reynolds Airport, Winston-Salem	160,000
NORTH DAKOTA	
Bismarck Municipal Airport	8,000
Dickinson Municipal Airport	32,000
Grand Forks Municipal Airport	62,500
Port O'Minot Airport, Minot	70,000
Sloulin Field, Williston	16,250
OHIO	
Akron-Canton Airport	400,000
Akron Municipal Airport	200,000
Port Bucyrus Airport, Bucyrus	10,250
Hopkins Airport, Cleveland	479,500
Cuyahoga County Airport, Cleveland	219,322
Lakefront Airport, Cleveland	200,000
Port Columbus Airport	700,000
J. M. Cox Airport, Dayton	500,000
Galion-Crestline Airport	17,000
Sandusky Municipal Airport	112,973
Youngstown Municipal Airport	63,658
OKLAHOMA	
Woodring Field, Enid	36,400
Guymon Municipal Airport	81,000
Max Westheimer Airport, Norman	61,000
Will Rogers Airport, Oklahoma City	266,000
Tulakes Airport, Oklahoma City	33,000
Ponca City Municipal Airport	48,500
Tulsa Municipal Airport #1	500,000
Wagoner - Sequoyah Park Airport	20,000
OREGON	
Corvallis Municipal Airport	22,392
Eugene Mahlon Sweet Field	15,493
North Bend Municipal Airport	11,420
Portland Int'l. Airport	877,430
PENNSYLVANIA	
Allentown-Bethlehem-Easton Airport	173,000
Bradford-McKean County Airport	125,000
DuBois Municipal Airport	76,000
Erie Municipal Airport	160,000
Lancaster Airport	140,000
Philadelphia International Airport	700,000
Greater Pittsburgh Airport	637,500
Schuylkill County Airport	100,000
C. A. Spaatz Municipal Airport, Reading	250,000
St. Marys Municipal Airport	50,000
Wilkes-Barre-Scranton Airport	250,000
Lycoming County Airport, Williamsport	92,041
York Municipal Airport	275,715
RHODE ISLAND	
T. F. Green Airport, Providence	650,000
SOUTH CAROLINA	
Greenville Municipal Airport	30,000
Greenwood County Airport	16,978
Sumter Municipal Airport	93,000
SOUTH DAKOTA	
W. W. Howes Municipal Airport, Huron	21,196
Rapid City Municipal Airport	12,983
Yankton Municipal Airport	24,462
TENNESSEE	
Tri-City Airport, Bristol	169,500
Lovell Field, Chattanooga	25,000
Outlaw Field, Clarksville	14,500
Cleveland Municipal Airport	21,000

PUBLISHING DATE

August 6, 1956

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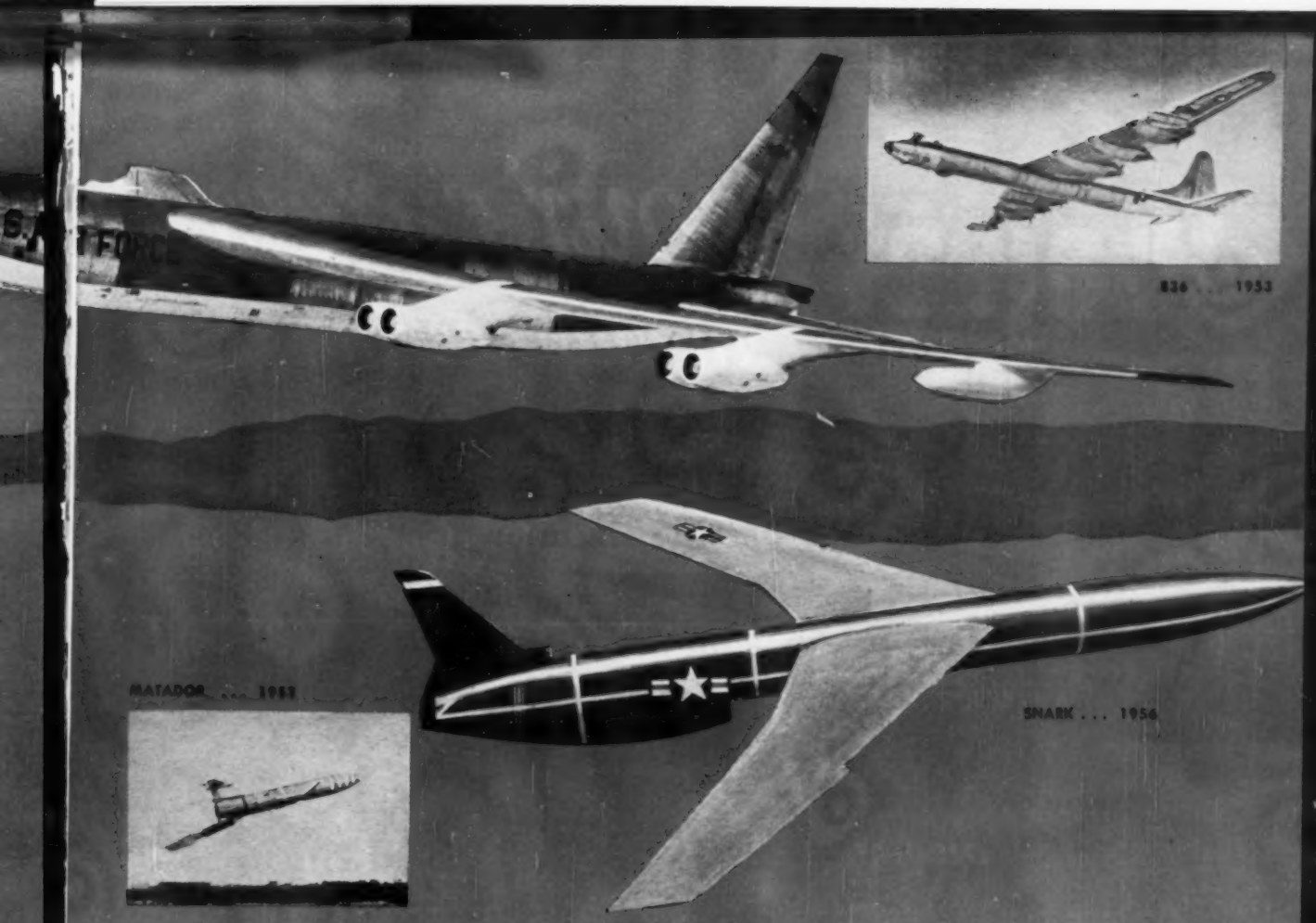

EXCERPT FROM HEADQUARTERS ARDC LETTER TO AVIATION WEEK

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MEMBER: A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

Putnam County Airport	50,000
Crossville Municipal Airport	66,000
Lebanon Municipal Airport	40,000
Franklin-Wilkins Airport, Lexington	30,000
Warren County Municipal Airport	43,000
Memphis Municipal Airport	212,000
Morristown Municipal Airport	35,000
Murfreesboro Municipal Airport	50,000
Berry Field, Nashville	1,000,000
Henry County Airport	25,000
Bomar Field, Shelbyville	40,000

TEXAS

Robert Mueller Airport, Austin	260,850
Stephens County Airport, Breckenridge	6,000
Rio Grande Valley Airport	21,750
Brownwood Municipal Airport	51,221
Burnet County Airport	27,423
Cliff Maus Municipal Airport, Corpus Christi	462,000
Love Field, Dallas	317,334
Denison Municipal Airport	25,000
Meacham Field, Fort Worth	24,000
Harlingen Municipal Airport	178,576
Hereford Municipal Airport	139,500
Houston Int'l. Airport	339,000
Jasper County Airport	8,000
Lamesa Municipal Airport	15,000
Littlefield Municipal Airport	30,375
Lubbock Municipal Airport	45,240
McAllen Municipal Airport	63,529
Midland Air Terminal	60,950
Mount Pleasant Municipal Airport	5,500
Cox Field, Paris	25,000
Ferryton Municipal Airport	20,250
Municipal Airport, Plains	11,615
Hale County Airport, Plainview	90,000
San Angelo Municipal Airport	133,500
San Antonio Int'l. Airport	358,529

UTAH

Manti-Ephraim Airport	23,734
Carbon County Airport	38,760
Salt Lake City Municipal Airport #1	652,279

VERMONT

Barre-Montpelier Airport	45,000
Newport Airport	9,000
Rutland Municipal Airport	157,500
Hartness Municipal Airport, Springfield	13,475

VIRGINIA

Preston Glen Airport, Lynchburg	125,000
Mount Jackson Airport	45,490
Patrick Henry Airport, Newport News	299,000
Woodrum Field, Roanoke	85,019
Shenandoah Valley Airport, Staunton	50,000

WASHINGTON

Omak Airport	8,278
Pasco Airport	24,706
Pullman-Moscow Regional Airport	15,263
Boeing Field, Seattle	177,468
Seattle-Tacoma Int'l. Airport	910,590
Geiger Field, Spokane	51,740
Pangborn Field Wenatchee	91,570

WEST VIRGINIA

Mercer County Airport	22,783
Benedum Airport, Clarksburg	109,000
Tri-State Airport, Huntington	314,000
Greenbrier Airport, White Sulphur Springs	8,700

WISCONSIN

Ashland Municipal Airport	20,000
Crandon Airport	36,550
Hartford Municipal Airport	60,000
General Mitchell Field, Milwaukee	220,250
Rhinelander-Oneida County Airport	75,000

WYOMING

Cheyenne Municipal Airport	214,388
Cody Municipal Airport	10,291
Municipal Airport, Evanston	26,693
Gillette Municipal Airport	10,291
Jackson Hole Airport, Jackson	28,585
Mondell Field, Newcastle	20,581
Rawlins Municipal Airport	25,727
Riverton Municipal Airport	17,151
Rock Springs Municipal Airport	14,864

Sheridan County Airport	14,864
Torrington Municipal Airport	9,147

ALASKA

Municipal Airport, Bethel	300,000
Municipal Airport, Homer	315,000
Municipal Airport, Kiana	90,000
Municipal Airport, Kivalina	45,000
Municipal Airport, Kokrines	56,250
Municipal Airport, Kotzebue	75,000
Sand Point Airport	225,000
Sitka Seaplane Ramp	11,250
Municipal Airport, Sleetmute	37,500

HAWAII

NONE

PUERTO RICO

Puerto Rico Int'l. Airport, San Juan	609,242

VIRGIN ISLANDS

NONE

Willow Run Project Follows Airline Nod

Detroit—Following word from airlines at Willow Run airport that they would remain rather than follow American Airlines, which is moving its Detroit terminal to Wayne Major airport, a decision has been made to begin an extensive $1.5 million improvement program.

Airlines National Terminal Services Co. promised the airlines that it will install:

- **Air-conditioning** for the entire terminal.
- **New flooring.**
- **New false ceiling.** (Present ceiling is open steel girder type.)
- **New, specially** designed seats.
- **"Self-claim"** baggage system.

In addition, the coffee shop is to be converted into a cafeteria. The observation ramp, restrooms, and heating of the concourse leading to ramps are to be renovated or remodeled, and exit-entrance areas are to be improved, including placing of a canopy at the west side of the terminal.

Minoru Yamasaki of Detroit, who won an American Institute of Architects award for his design of the St. Louis Air Terminal, will handle the Willow Run project.

Brazilian Airline to Start Chicago Service

Brazilian International Airlines (REAL) on Aug. 15 will inaugurate service between Chicago and South America.

The once-weekly flights will stop at Miami, now served by REAL with three weekly schedules.

The Brazilian carrier, whose international route includes Buenos Aires, Montevideo, Sao Paulo, Rio de Janiero, Port-of-Spain and Caracas, operates DC-4 equipment into Miami. REAL recently has acquired three DC-6Bs, one of which may be used in the Chicago service.

REPLIES (Box No.): Address to office nearest you c/o This publication Classified Adv. Div.
New York: P. O. Box 12 (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

POSITION VACANT

Analysts—Traffic & Economics. Executive offices in eastern city. Age 25-35 preferred. P-1155, Aviation Week.

POSITIONS WANTED

Navy Comdr available June 30 for executive pilot 6000 hrs. ATR DC-6. Write R. L. Gulick 1190Brucito Los Altos Calif. or phone Yorkshire 7-9545.

Dayton Representative available—ten years experience obtaining Air Force contracts. PW-2196, Aviation Week.

Non-US-citizen (Dutch; 1st Paper Issued) 16 yrs mil. pilot experience. Engineering and operat. background. 3½ yrs extensive field experience as qualified, USAF and USC trained, aircraft accident investigator (jet & convent.) age 38, married, college (French, German, Dutch) desires intelligent and exacting aviation work. PW-2282, Aviation Week.

Cataloguing Specialist—Air Force and Feder al systems. Age 33. AMC trained. Prime aircraft contractor experience. Capable of complete organization and management. Resume and references on request. PW-2283, Aviation Week.

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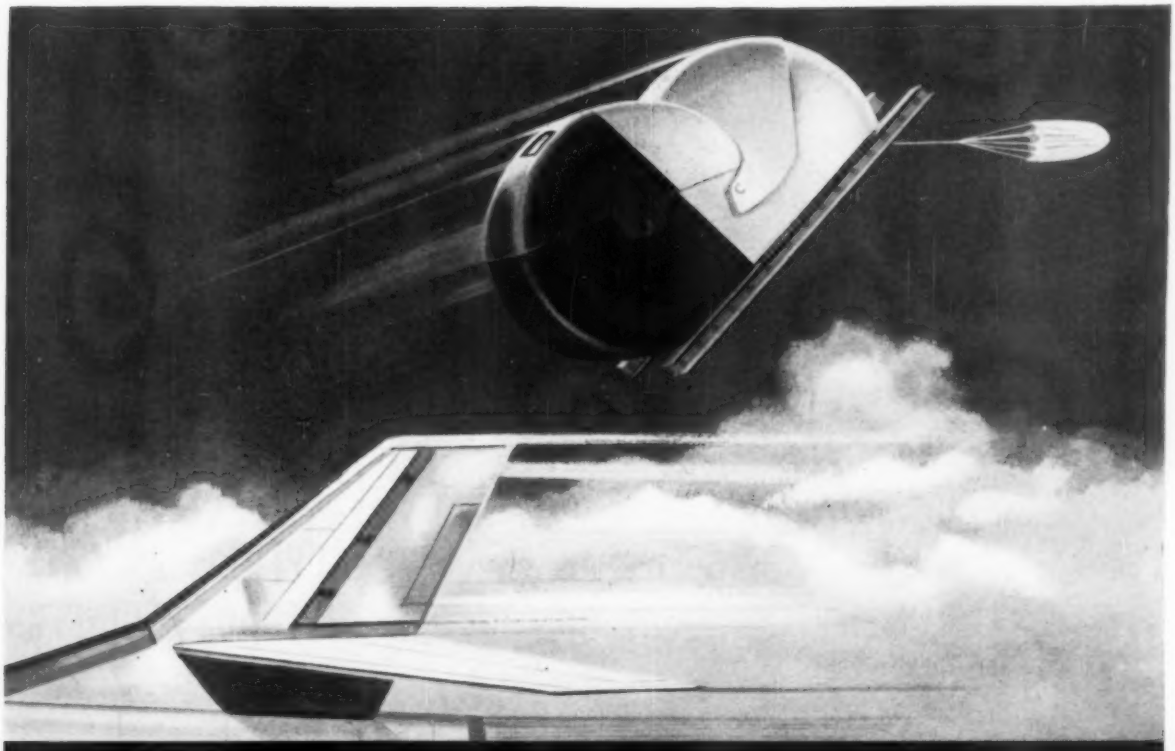

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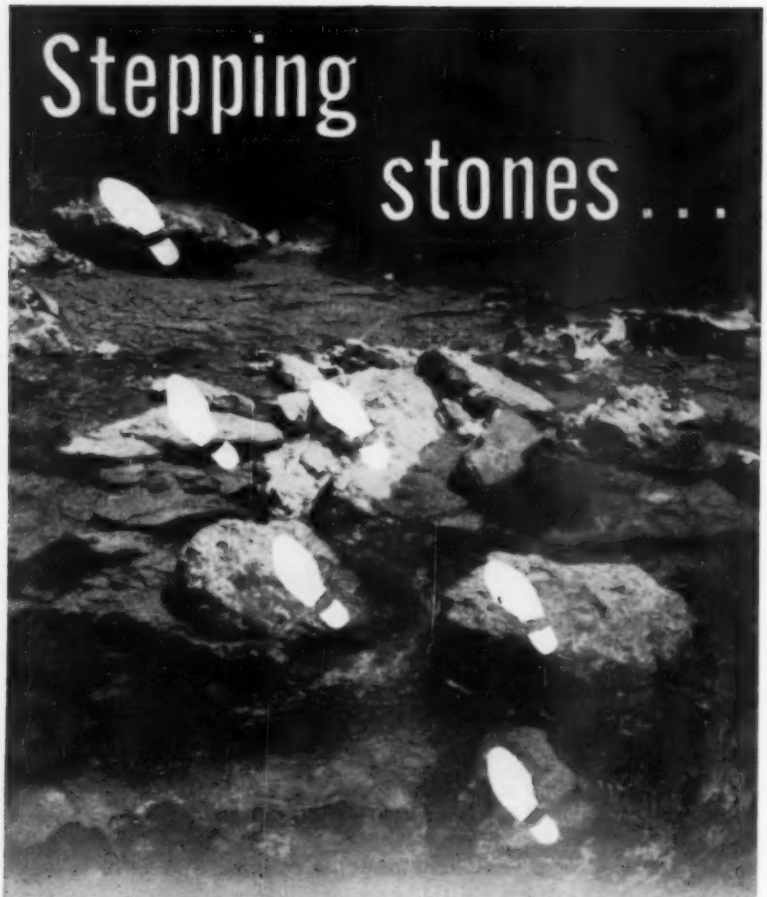

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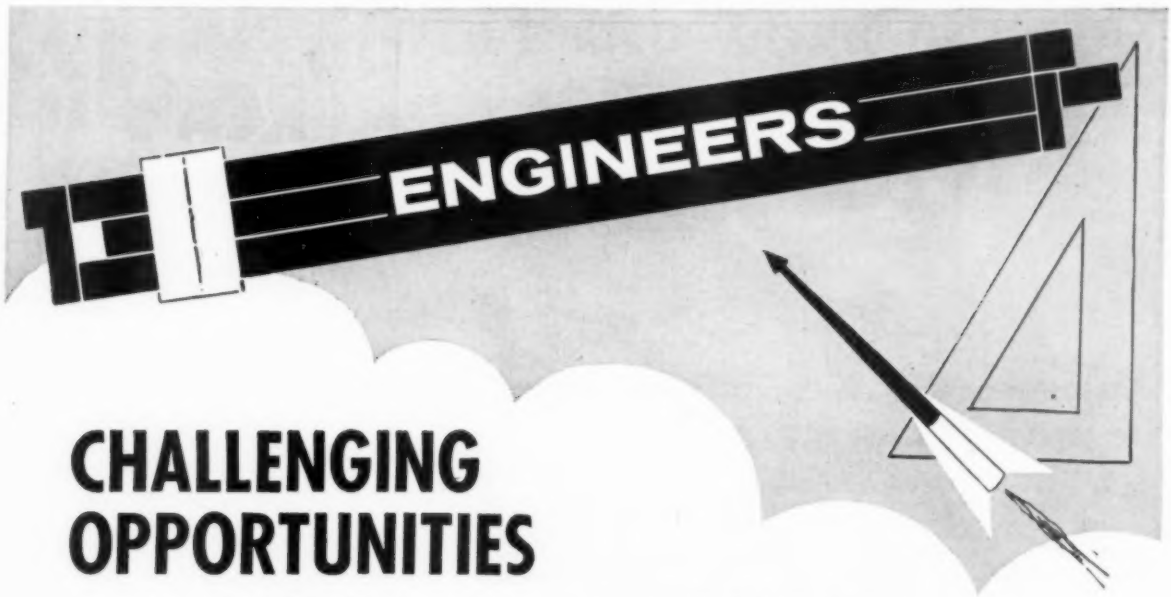

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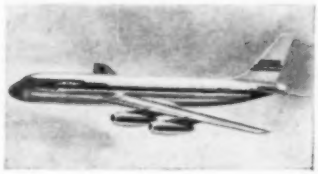

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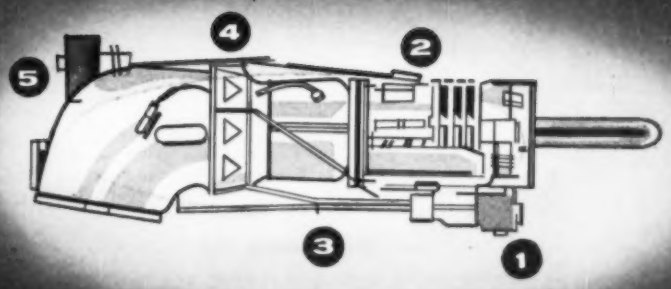

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LETTERS

Anti-Douglas Engineer

A Letter to the Editor was published in Aviation Week July 11, p. 146, over the signature of "Douglas Engineer," which was grossly exaggerated as to "lax management" and to the level of engineering work. Although the letter contained many half-truths, a further look into the Douglas engineering departments may well be in order.

No individual is capable of intensive concentration 100% of the time; it is necessary to relax occasionally. There are a few who would abuse this privilege, as there are those who feel that anything less than 100% concentration is "milking the taxpayer." Perhaps for the short period of three years in the industry, the young engineer is still fully capable of working without periods of relaxation. The three-year engineer is certainly not ready to be placed in a position of responsibility, because he lacks background experience from which to draw and because his judgment is insufficiently developed.

The allegation of "a very lax management" in disciplinary areas may better be pointed in the direction of the delegation of design responsibility. If more of the design decisions were delegated to the designers, not only would the "shortage of engineers" be relieved somewhat by more proper utilization of existing engineering talent, but also the same designers could not be referred to as "glorified draftsmen."

To say that the SCPEA-ESA "union" represents the "glorified draftsmen" at the Douglas Company is simply not borne out by the facts. SCPEA-ESA includes within its scope all engineers in the engineering division up to the supervisory level, which includes the design engineer, aerodynamics engineer, computing specialist, design specialist, etc. Furthermore, in a recent appointment to supervision of 31 engineers, 29 were members of the Southern California Professional Engineering Association. Of these, six were past unit chairmen, five were officers, and 18 were also active members; two were non-members.

MAX J. MAYFIELD, PRESIDENT
Southern California Professional Engineering Association
Gardena, Calif.

Engineering Sore Spot

A reply to the "Angry Douglas Engineer."

You have put your finger on a very sore spot, that of overpaid, glorified draftsmen with their coffee breaks, extended lunch periods, and rubber band wars, working (?) overtime to the extent that they meet themselves coming back. But you are not looking at both ends of the finger. The behavior that you rightly condemn is juvenile and irresponsible, but a man's own integrity should put an end to it.

The lax management that you refer to might just possibly be due to supervisors or group engineers, or what have you, having to expend a huge amount of time seeing to it that all of the work put out by their groups is correct, clear and acceptable.

I am glad to note that you have seen the folly of an engineers union or a collective bargaining unit for engineers.

A contributing factor to this "engineering shortage" mess is the fact that there are quite a few "empire builders." These men overstaff their groups and sit tight on their men, preventing them from locating and securing the jobs or positions that would utilize their talents to the greatest extent.

I hope we, generally speaking, can find a way out of this "engineering shortage" mess and go on to an "Engineer's Utopia," every man working at his own most useful and rewarding job, without taking a $25 a month merit decrease.

A MARTIN ENGINEER

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

For 'Douglas Engineer'

The letter from "Douglas Engineer" in the June 11 issue really hit the nail on the head. Though he mentioned that "a very small percentage of supervisory personnel make virtually all of the design decisions," perhaps he neglected to add that, in most cases, this same group frequently stifles any ideas from the ranks. This is done usually by a pocket veto, by outright derision, or some equally rude method.

Aside from this addition, it is agreed that it is management's fault for the laxity which allows loafers to compete with engineers whose integrity and self-respect makes them want to work to earn their pay. It is high time a capably administered evaluation system be instituted to separate the men from the boys, and to distribute rewards accordingly. Problem: find some capable administrators.

It is situations such as this that make for the gross inequities in salaries frequently found in the industry. Each worker seems to be carrying a loafer on his back. The sooner the worker realizes he is paying the loafer's salary, the sooner there might be an end to the so-called shortage of engineers.

In today's market, nobody fires a man who knows which end of a pencil writes. A tougher attitude would benefit everybody, especially those who deserve to be benefited. This situation is not unique with our industry, but merely reflects the worst face of our present full employment. The employer who breaks through this barrier will really forge ahead. He, his employees and his customers will all benefit. The question is: who has guts enough to start such a profitable program?

MARYLAND ENGINEER

But Money Helps

I have just completed reading Mr. Ball's article in the June 18 issue (p. 79, 81, 82, 83) of Aviation Week. For the most part Mr. Ball is correct in his assumption that monetary considerations do not constitute the entire spectrum of an engineer's wants and desires.

However, when journeyman plumbers, carpenters, and some machinists earn more money than an engineer with a B. A. degree in Mechanical Engineering it is an indication that something is still left to be done in the salary department.

It is true that when an engineer owns his own home, his own car, a substantial bank account, he can then turn to the more aesthetic values as "competent inspiring leadership."

But let's get one thing straight. Any engineer who makes slightly more than $400 per month, who has to fight for raises to stay ahead of graduating engineers who are "new hires," and who has monthly bills to meet needs courage to raise his mind to a higher plane. This same engineer is going to take a long, slow and careful look at any company that offers him $450 per month and in addition will pay his moving expenses.

Mr. Ball may have based his conclusions on conversations with group engineers or project engineers, but he should have remembered there are a lot of us who are not and will not be in this income level for many years to come.

I do not say that an engineer with a B. A. degree should make as much money as a doctor or lawyer but there should not be the existing wage differential.

The recent articles by Aviation Week have been well written and highly interesting though slightly amusing. I suggest you print them in a series entitled "What can we give engineers instead of money?"

In conclusion let me say that my degree and three years experience have given me about 20¢ an hour and I would very seriously consider entering into the market to do a little more collective bargaining no matter how much challenge I find in my present job. After all there are about six to eight challenging jobs to every engineer in this country and some of them pay better than others.

NAME WITHHELD

Not Angry—Honest

I fail to understand why the letter (AW, June 11, p. 146) should be captioned "Angry Engineer." As an employe of the engineering clerical personnel in an aircraft company, I feel that it expressed the exact thoughts and observations that I hope are in the minds of many "glorified draftsmen" and others—even though their positions are on a somewhat lower level category.

I certainly hope that the letter does not escape the eyes of top-side management of all aircraft companies.

The title of "Angry Engineer" should by all means be recaptioned "Honest Engineer." This letter alone renews my faith in mankind.

NAME WITHHELD

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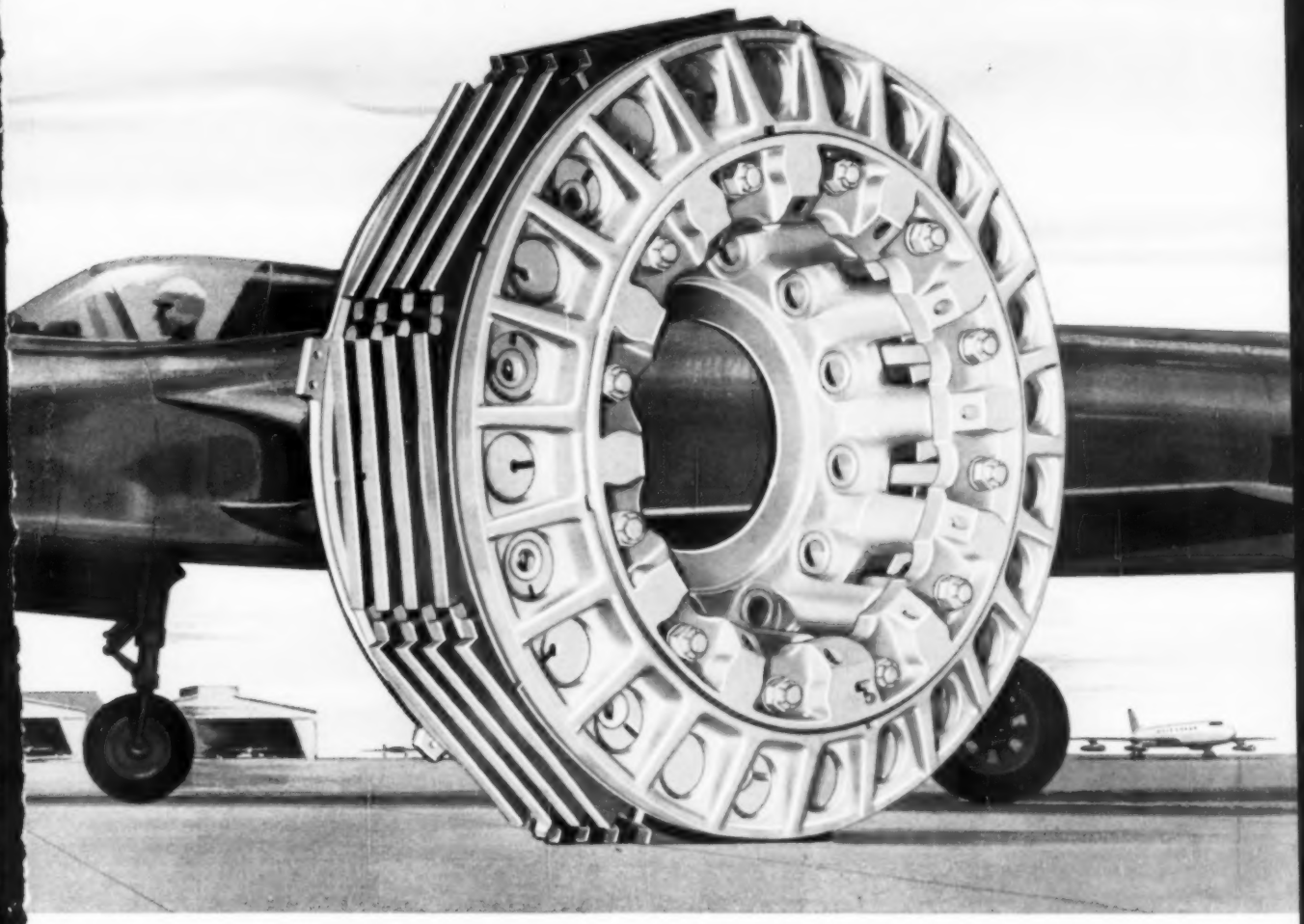

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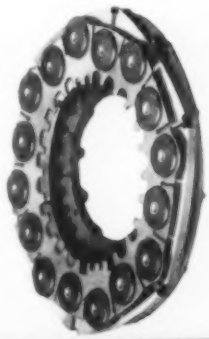

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